THE SOUTHERN FOREST EXPERIMENT STATION

FOREST SERVICE
U. S. DEPARTMENT OF AGRICULTURE

FOREST RES PEOPLE

The Southern Forest Experiment Station States and the timbered portions of two others. contains one-fifth of the Nation's commercial and one-tenth of its timber. It yields nearly or the country's timber growth and produces nea cent of the pulpwood. It includes the most hardwood region in North America.

Through this booklet, we hope to share with our excitement over the discoveries that are im management and utilization of the area's timbe research deals with trees, wood, soil, and wat solely for the benefit of people—the landowne ers, investors, industrialists, workers, and outd asts of the region and the Nation.

We serve these people by . . .

. . . finding ways to increase timber grov supply. Our findings will provide more the land and greater profits to landown

. . . improving techniques and equipment for harvesting and transporting timber. These improvements will result in more jobs in tomorrow's woods and transportation industries.

. . . developing increasingly efficient methods for manufacturing wood products. These developments will mean more and better jobs in mills.

. . . discovering new wood products that will better satisfy the everyday needs of people.

. . . increasing the forest's output of nontimber resources—wildlife, forage for livestock, water, and recreation—to meet the needs of an expanding population.

The Southern Forest Experiment Station is part of a U. S. Department of Agriculture team that is winning renewed prosperity for rural Americans. The Department's nationwide program of development and revitalization for rural communities will require the best possible use of both natural and human resources. Forest conservation

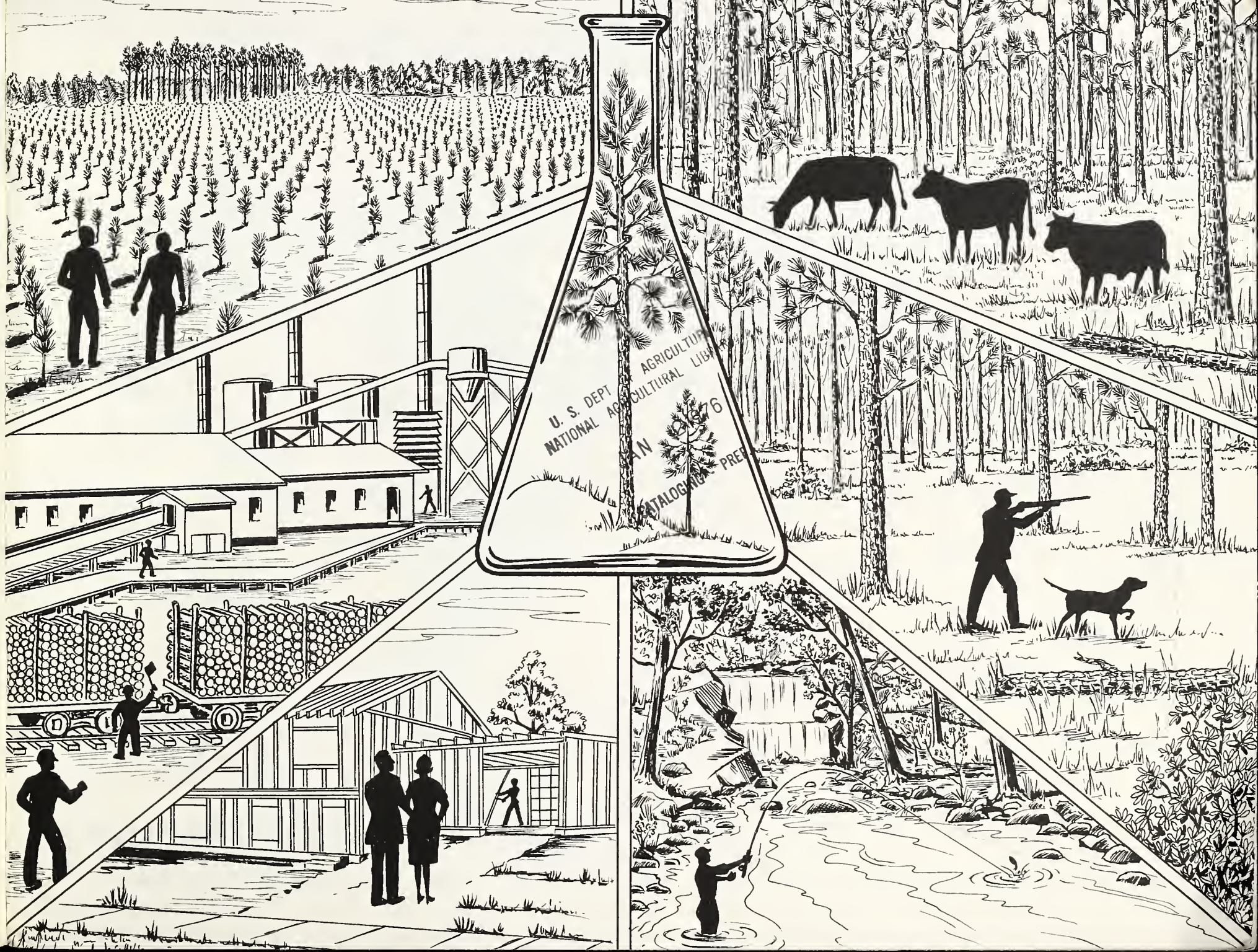
val and development; it must serve as rural life is to be improved. Forest ing how best to integrate conservation lopment.

cation receives valuable assistance from industrial firms, schools, associations, ate and Federal governments. These such aids as land, timber, buildings, nd special skills and services. In doing y experiments to completion and make earch that otherwise could not be at-

Southern Station, as at Stations in other is organized by field projects. These ations are mapped on page 3, are indiin this booklet. Each is identified with and geographic region, a climatic zone, field.

T. C. NELSON
DIRECTOR

1968



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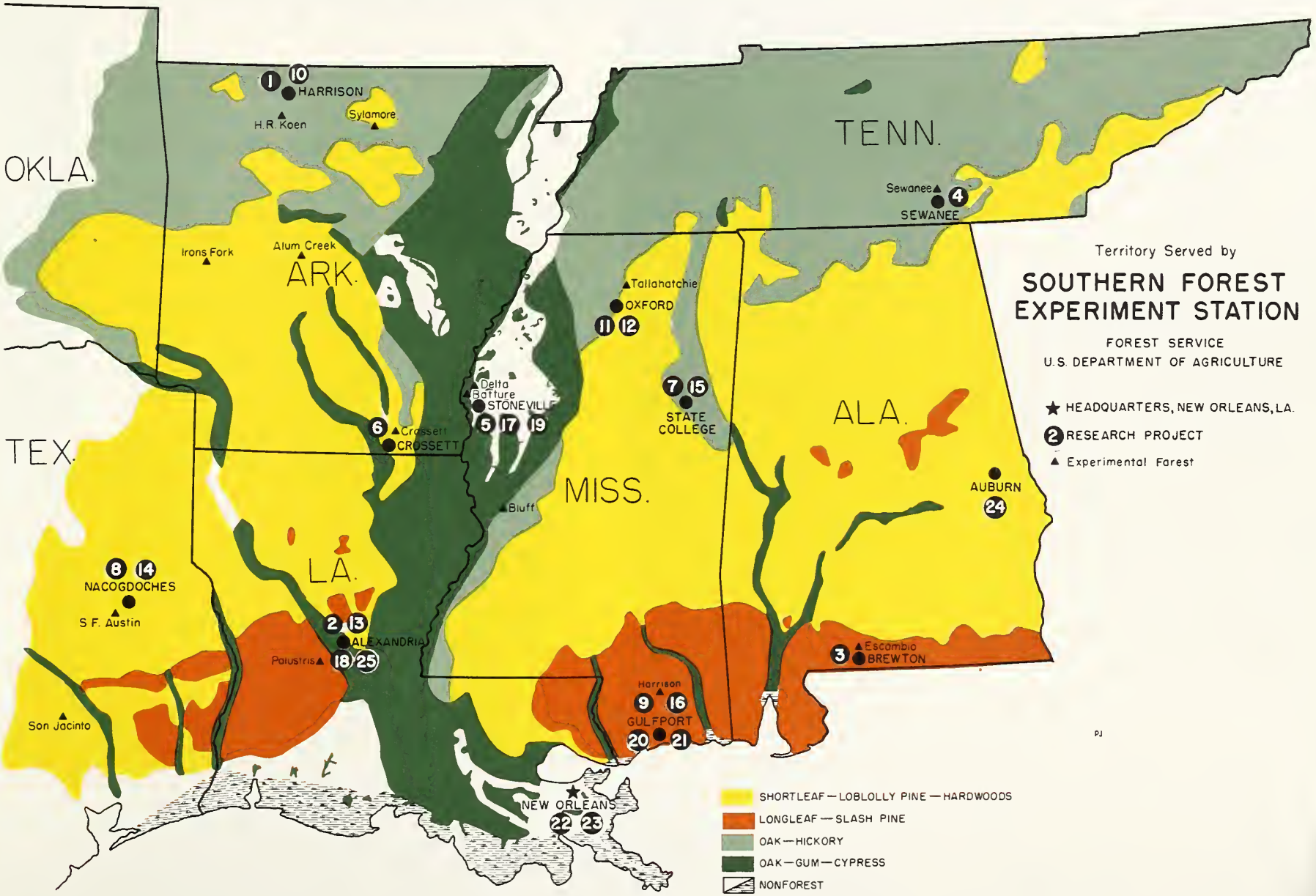
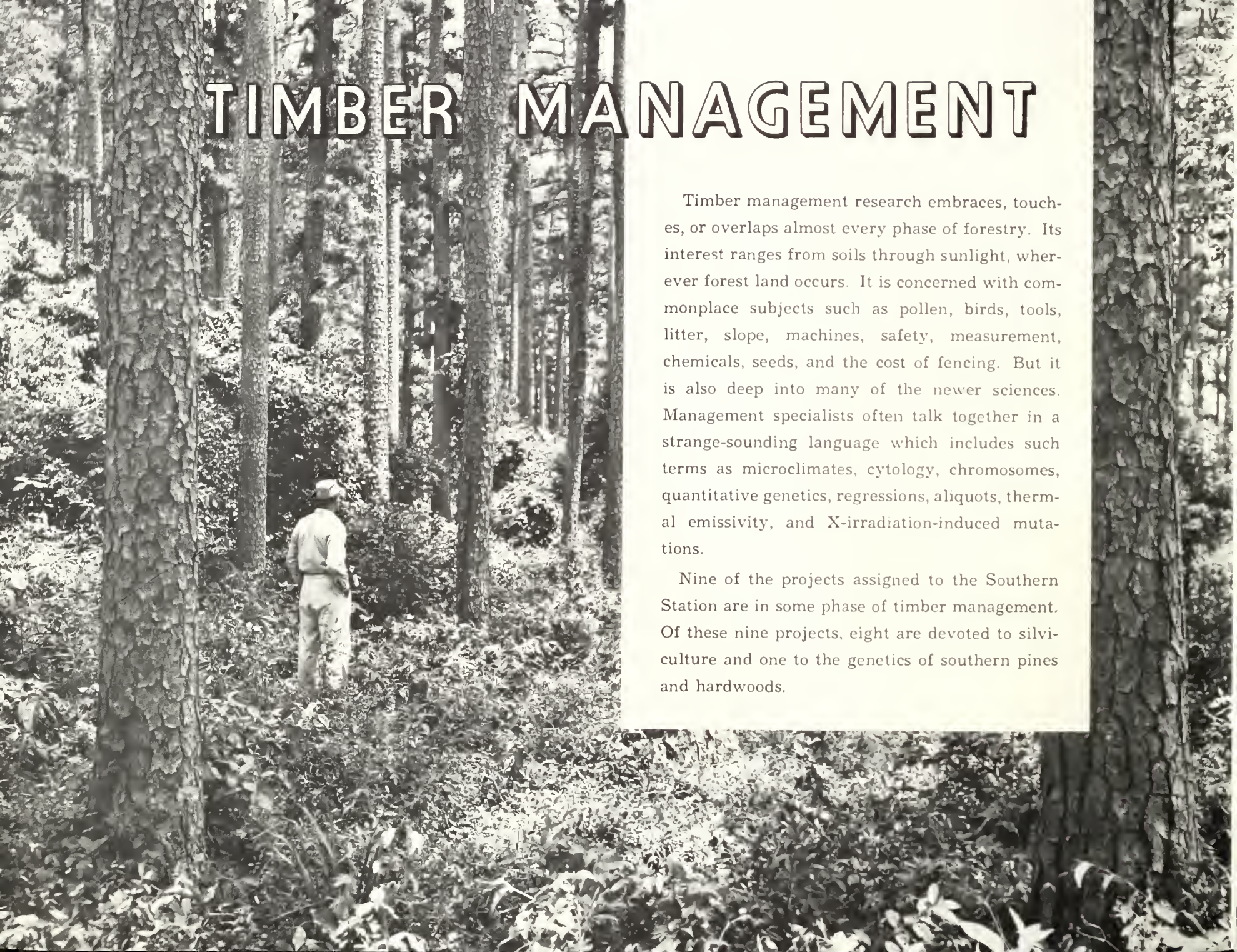




TIMBER MANAGEMENT

Timber management research embraces, touches, or overlaps almost every phase of forestry. Its interest ranges from soils through sunlight, wherever forest land occurs. It is concerned with commonplace subjects such as pollen, birds, tools, litter, slope, machines, safety, measurement, chemicals, seeds, and the cost of fencing. But it is also deep into many of the newer sciences. Management specialists often talk together in a strange-sounding language which includes such terms as microclimates, cytology, chromosomes, quantitative genetics, regressions, aliquots, thermal emissivity, and X-irradiation-induced mutations.

Nine of the projects assigned to the Southern Station are in some phase of timber management. Of these nine projects, eight are devoted to silviculture and one to the genetics of southern pines and hardwoods.

SILVICULTURE OF THE OZARK PINE TYPE

Harrison, Arkansas

The Arkansas Ozarks: 11 million acres, two-thirds forested; much of the forest abused and growing low-grade timber; rainfall erratic, droughts common; soils and topography highly variable within short distances.

There, indeed, is a problem. Can it possibly be considered an opportunity? The answer is "yes;" the area has great potential.

First of all we know that Ozark trees can be valuable. Among the hardwoods, for instance, good white oak always finds a ready and profitable market. It is unequalled for bourbon barrel staves, and brings premium prices for veneer and flooring.

Information on seed dispersal and numbers and heights of seedlings will aid in prescribing the number and spacing of seed trees to be left when stands are harvested.

Shortleaf—the only one of the four major southern pines native to the Ozarks—survives rugged sites and seasons; its wood is utilized for construction and pulp.

The research project at Harrison is working in three major fields to develop profitable management techniques for Ozark forests:

Species adaptability. There is an urgent need to understand the relationships between soil, site, and tree species.

Stand conversion. A great opportunity obviously lies in converting low-grade stands to pine and good hardwoods. Researchers will test various methods of site preparations, seeding, and planting.

Silviculture. Until the past few years, "silviculture" in the region consisted mainly of cutting anything that looked merchantable. What the forest scientists at Harrison can learn about methods and cycles of harvesting tree crops, inducing successful natural regeneration, and thinning the stands will help restore productivity on millions of acres of Ozark Highlands.

ESTABLISHMENT AND MANAGEMENT OF SOUTHERN PINE PLANTATIONS

Alexandria, Louisiana

Plantation establishment. Direct seeding of forest trees—long considered an impossible feat—became practical after researchers at Alexandria found a chemical seed coating that would repel birds and rodents. This breakthrough came in 1956, and since that time about 1 million acres have been sown at a savings of almost $10 million over the cost of planting. Equally important, many sites have been restored to production which might otherwise have remained barren. Research is still continuing to reduce sowing rates and costs, and to adapt techniques to the more difficult sites.

Seed research, an integral part of direct seeding, has also provided many important developments in collecting, processing, and storing seeds of the southern pines.

Plantation management. Studies to determine how best to manage plantations for maximum profits are already well advanced with loblolly, slash, and longleaf pines. Various thinning methods, stand densities, cutting cycles, and pruning systems are being tested. Also under study are the effects of initial stocking and spacing on subsequent production of direct-seeded stands.

Soaring demands for raw materials, a shrinking land base, and rising costs of land ownership and management all show the need for research to greatly promote growth and yields of pine plantations.

It is anticipated that wood crops will be cultured just as other agricultural crops are. Practices that must be evaluated include amelioration, cultivation, fertilization, and irrigation. Research has been started to learn how to apply treatments, the amenability of different soils to improvement, and the responses on soils of various types.

Control of forest weeds. For more than two decades the Alexandria unit has pioneered in chemical control of cull hardwoods and weed species. A number of new techniques have been formulated, each improving effectiveness and reducing costs. These are in widespread use across the South. Since manufacturers are constantly developing new chemicals and tools, a continuing screening program is necessary.

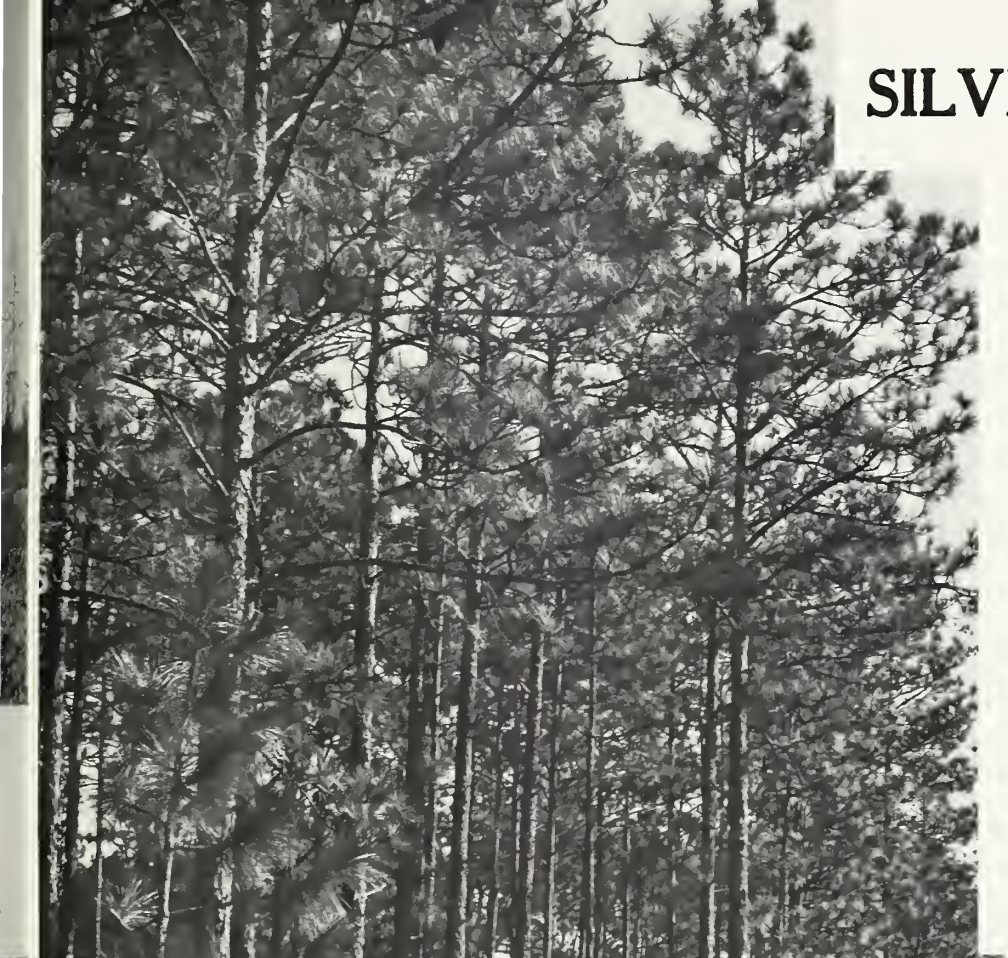
Foliar spraying is the least reliable and most costly of all methods for controlling unwanted hardwoods. But on steep topography or in dense stands of very small stems, it is often the only practical way. Consequently, intensive work is being done on the absorption, translocation, and metabolism of herbicides, and on leaf morphology of hardwoods.

Advanced methods of killing cull trees are being developed at Alexandria.

Direct seeding from the air has proved fast, economical, and efficient.

The South has a tremendous acreage of pine plantations. How should such stands be managed for various wood products and maximum yields?

SILVICULTURE OF LONGLEAF PINE



Brewton, Alabama

Longleaf pine silviculture is one of the most perplexing problems in southern forestry. The chief difficulty is getting new stands started when old ones are harvested. Longleaf can be direct seeded readily, but in many situations landowners would prefer regeneration by natural seedfall from the mature trees—provided that they could get it promptly and reliably. Several million acres of longleaf stands are now approaching harvest age. Most of them are along the Gulf Coast east of the Mississippi River.

A major aim is to develop economical methods of natural regeneration, and therefore the research includes the study of seed crops, seedbed requirements, and seedling survival and growth.

Another purpose is to develop methods for managing natural stands. Landowners need to know when and how to thin, and what stand densities are best for various purposes.

Prescribed fires are essential to the management of longleaf pine. Relations of such fires to overstory and understory vegetation, and to site conditions and regeneration, are being investigated.

Scientists also are studying the effects of site on regeneration and management. They hope to identify the growth potential of various sites and to devise a system of site classification.

SILVICULTURE OF PLATEAU FORESTS

Sewanee, Tennessee

In 1903, the U. S. Bureau of Forestry (which later became the Forest Service) reported on 6,655 acres of timberland near Sewanee, stating that, " . . . . $3,000 for all the timber was considered a fair offer . . . . "

The same report says why the timber was valued at less than 50¢ per acre:

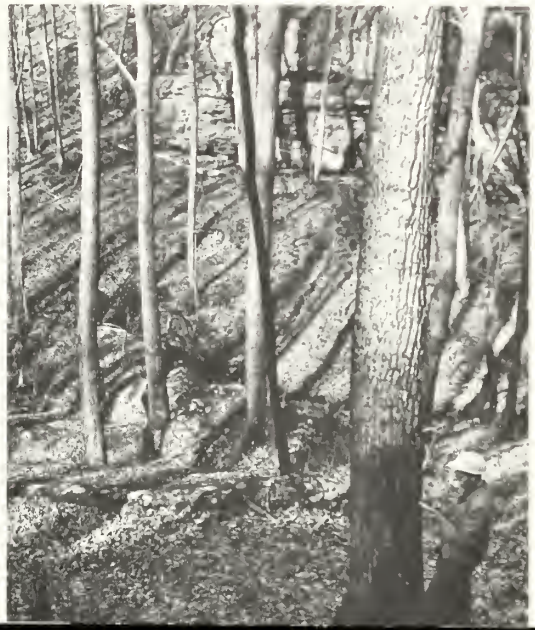
> *"Grazing, burning, and careless cutting have wrought great mischief in the plateau forest."*
>
> *"Repeated fires gradually consume all of the forest floor and render the chance of its forming again less and less likely."*
>
> *"Few seed-bearing trees are found, and most of the reproduction is by sprouts."*

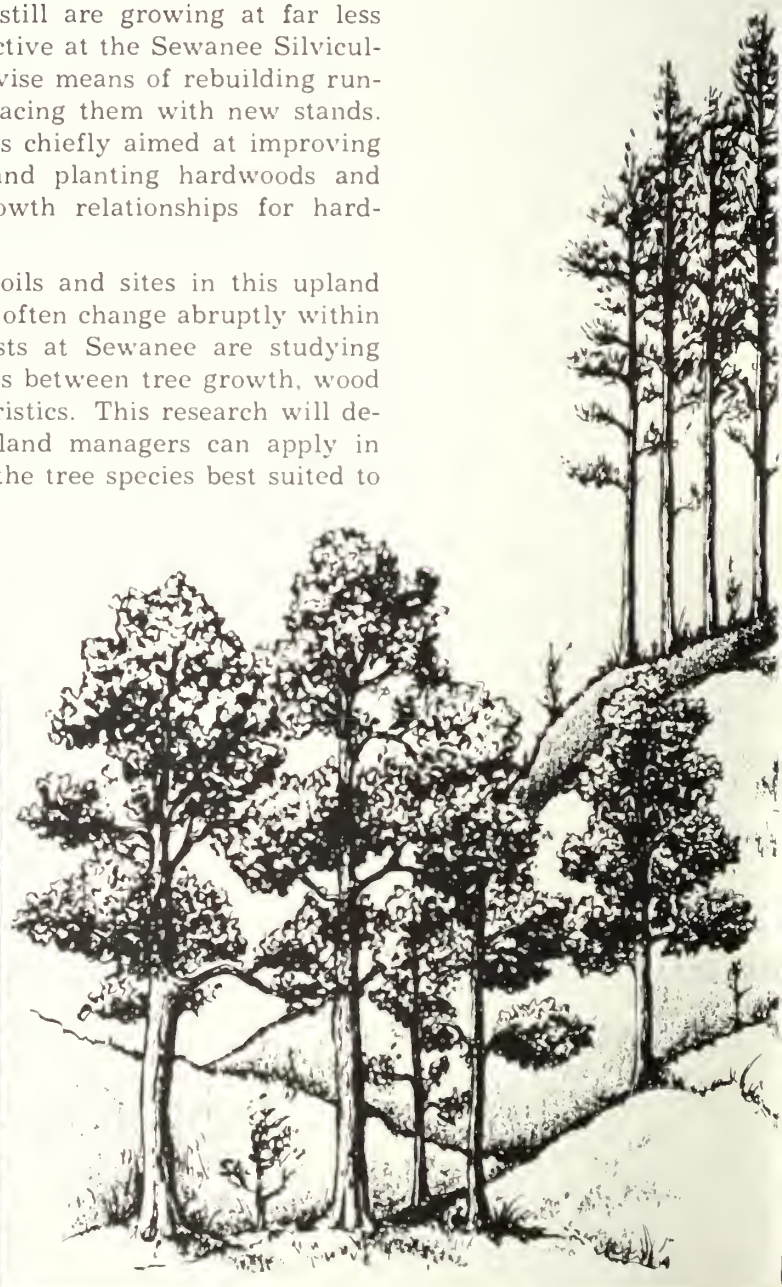
In the decades since that early report, some forests of the Cumberland Plateau and Highland Rim in Tennessee and north Alabama have responded well to management, but most still are growing at far less than capacity. The objective at the Sewanee Silviculture Laboratory is to devise means of rebuilding rundown woodlands or replacing them with new stands. Consequently, research is chiefly aimed at improving techniques of seeding and planting hardwoods and determining tree-soil-growth relationships for hardwoods and pines.

The qualities of the soils and sites in this upland region range widely and often change abruptly within short distances. Scientists at Sewanee are studying the intricate relationships between tree growth, wood yields, and site characteristics. This research will develop information that land managers can apply in selecting and managing the tree species best suited to each site.

Shortleaf pine is a good timber species in Plateau forests. It is well adapted to the ridges and northern slopes of these highlands.

Coves of the Plateau can support valuable stands of hardwoods. Research is finding ways of rebuilding rundown stands.





SILVICULTURE OF SOUTHERN HARDWOODS

Intensive culture of plantations, as in this test of sweetgum progeny, is necessary and profitable for some hardwood species.

Stand management research aims to produce quality hardwoods in the shortest possible rotations.

Stoneville, Mississippi

About half the southern forest is made up of hardwoods on bottom lands and swamps along major rivers, on bottoms of narrow streams in many parts of the Coastal Plain, and on uneroded loess uplands. Sweetgum, oaks, cottonwood, tupelos, yellow-poplar, black willow, and dozens of other broad-leaved trees will grow well on these sites. The Southern Hardwoods Laboratory is centrally located for the study of these forests. Its scientists are developing knowledge and techniques for managing plantations and natural stands for rapid growth and high-quality wood.

Stand establishment. In past work, the Laboratory developed reliable methods for planting eastern cottonwood, which are now being used to establish thousands of acres of commercial plantations. It has devised tentative methods for planting green ash, sycamore, and tupelo, and is now concentrating on improving the methods for these species and extending them to others. In particular, sweetgum and the oaks are notoriously hard to plant under forest conditions but far too valuable to be ignored. A start has been made on the direct seeding of some of these species.

Stand management. Hardwood stands must be thinned and freed of weed trees if they are to grow well. They must be inventoried so that thinnings and harvest cuts can be planned at optimum times and for the optimum mix of products—for while an increasing acreage of hardwoods is being grown solely for pulpwood, the typical stand of the future will be carried on a rotation long enough to develop prime logs for lumber and veneer. Improved methods for accomplishing all these tasks are being sought. Answer to another question is sought: How can damage by game be prevented when hardwoods are being seeded or planted?

Nutrition and site relations. Research has already developed guides to evaluate sites for major commercial hardwoods. Continued study of nutritional and moisture requirements, by species, will lead to methods for predicting site quality and improving site capabilities.

Tree improvement. Plantations of the future must be stocked with trees that have potential for superior growth and form, desirable wood properties, and pest resistance. The Laboratory, in coordination with the Institute of Forest Genetics, is developing genetically superior cottonwood, sweetgum, and cherrybark oak planting stock.

Wood properties. Wide variations in seasoning and processing characteristics often occur within species of southern hardwoods. Research is underway to determine the sources of this variation and to find ways of minimizing it.

This experimental cottonwood plantation on batture land near Stoneville is 5 years old. Trees average 6.5 inches in breast-high-diameter and 52 feet in height.

In this age of mechanization, it would be convenient to thin plantations by taking out whole rows rather than by selecting individual trees. This experimental row thinning was made to determine effects upon growth, yield, and tree quality.

One year's harvest on a demonstration 40-acre tract at Crossett. These products represent approximately 1 year's growth on the tract.

SILVICULTURE OF THE LOBLOLLY-SHORTLEAF PINE TYPE

Crossett, Arkansas

The Southern Station established the Crossett Timber Management Laboratory in 1934—the first field unit to be set up in the Midsouth. During the ensuing quarter century, the unit's research in second-growth pine stands showed that cutover and burned-over pine forests recover rapidly when managed properly.

In recent years, the multiplication and expansion of woodpulp mills and the establishment of plywood plants throughout the Midsouth are evidence that industry has become convinced that managed forests can produce sustained yields. Now landowners are asking: "How can we grow more and better timber on our land—and in less time?" Crossett research is largely oriented to answer this question. Subjects include determination of optimum cutting cycles and rotation age, preparation of seedbed prior to regeneration, improvement of trees through selective breeding, determination of factors that affect seed production, prediction of site quality, and relation of tree growth to site quality and stocking.

The growing of large, high-quality logs for veneer and lumber is a major subject of research at Crossett.

TECHNOLOGY OF FOREST TREE SEED

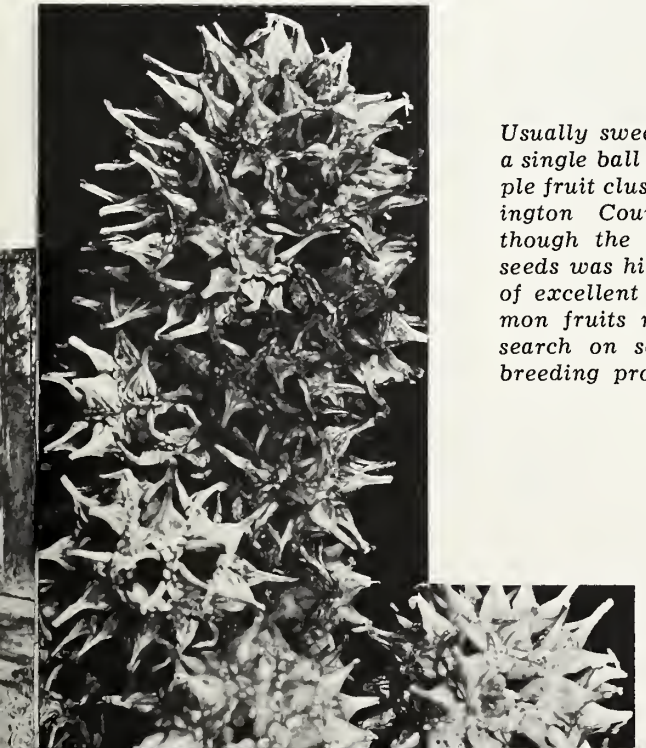
State College, Mississippi

Already, several hundred thousand pounds of tree seed are sown in the South each year. Much greater quantities will be needed in the near future, as forestry programs expand. Seed of genetically improved constitution is becoming available in increasing amounts.

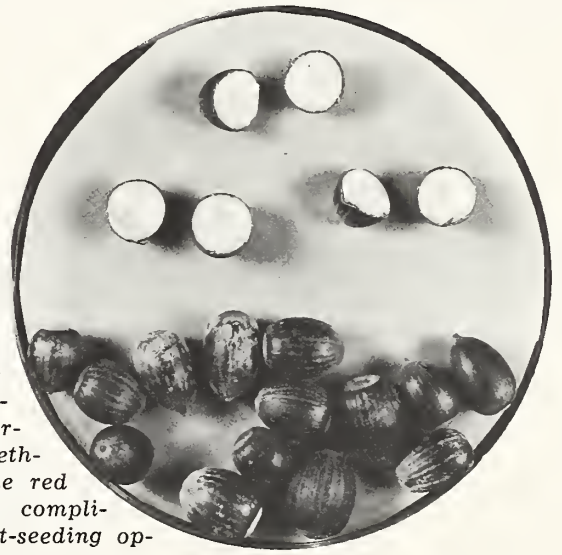
Most of the seed sown today is pine, but interest in hardwood sowing is rising rapidly. Reasonably reliable methods of handling pine seed are available, though substantial improvements are possible. Knowledge of hardwood seeds is rudimentary. And in all species, pine or hardwood, the high value of seed from genetically selected trees necessitates methods of collecting, storing, testing, and sowing that will minimize damage and loss.

To meet the expanding need for information on such subjects, a new project was established at State College, Mississippi, in 1966. The research is in cooperation with Mississippi State University's School of Forestry and with the Mississippi Agricultural Experiment Station.

The aim is to find ways of maintaining or enhancing germinative capacity through study of the physiological changes that occur in seeds from ripening to germination; to improve methods of collection, cleaning, and storage; to learn the best way of treating seed to speed germination; and to devise tests of germinative capacity. The scientists are concentrating first on hardwoods, but their interest extends to seeds of all eastern forest tree species.



Usually sweetgum seed is borne in a single ball or head, but this multiple fruit cluster was found in Washington County, Mississippi. Although the proportion of unfilled seeds was high, the full seeds were of excellent quality. Such uncommon fruits may be helpful in research on seed formation and in breeding programs.



Acorns are among the difficult seeds to deal with. Sound acorns, such as those shown here, have such high moisture contents that long-term storage by conventional methods is infeasible. In the red oaks, slow germination complicates nursery and direct-seeding operations.

COMBINING TIMBER PRODUCTION WITH GAME MANAGEMENT

Nacogdoches, Texas

If you're managing a forest to grow timber, can you also manage it to grow game in huntable numbers? Most foresters nowadays are convinced that the answer is Yes. They feel that, with some adjustments in managerial techniques, dual crops of wood and game are feasible as well as desirable. They are much less sure of the exact nature of the adjustments—and that is why there is a timber management project at Nacogdoches, as well as a project in wildlife habitat management. Scientists of the two projects work closely together on the multiple-use management of southern forests.

Timber management scientists at Nacogdoches are learning how various concentrations of wildlife—especially quail and deer—affect production of timber in managed forests, and how management for both resources can be effectively combined. To this end they are measuring the amount of timber lost when land is allocated to game food patches and water holes, and when stands are kept thin enough so that game food plants flourish in the understory. They are trying various schedules of prescribed burning to benefit both trees and game food plants. Eventually they will be able to assess the profitability of various degrees of dual management.

GENETICS OF SOUTHERN PINES AND HARDWOODS

Gulfport, Mississippi

There are about 105 billion trees in the South. No two of these trees are identical. They vary in countless ways: in size, shape, growth rate, wood density, root structure, needle length, color, and resistance to pests. Heretofore we have used this wild stock to reproduce forests, and we have done so in almost complete ignorance of its genetic desirability.

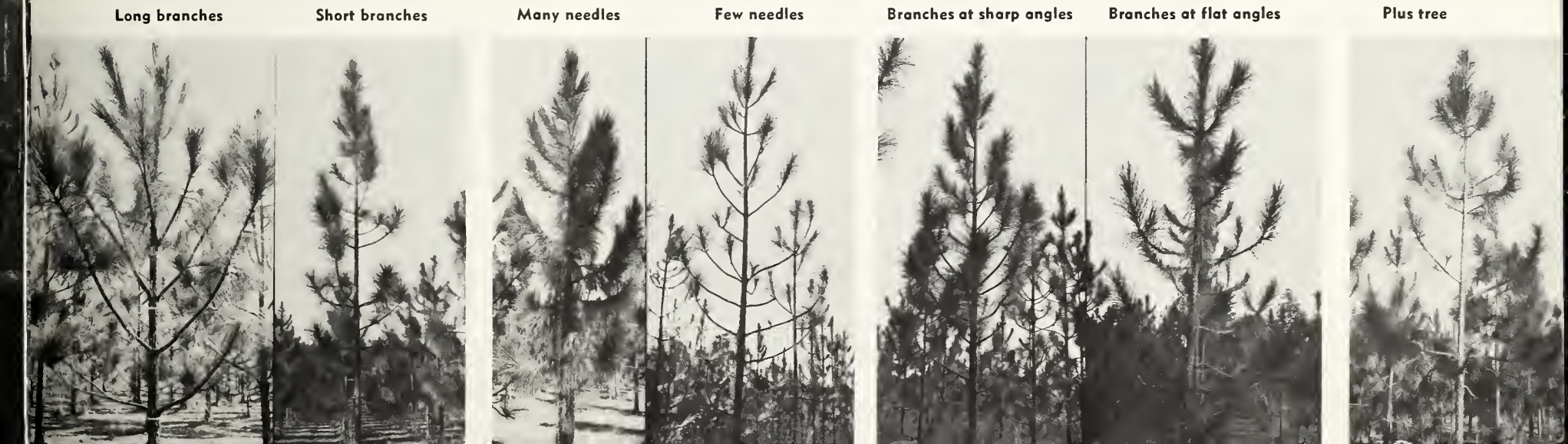
The Institute of Forest Genetics was established at Gulfport in 1955 to determine the role of inheritance in controlling the desirable characteristics in forest trees.

Research is mostly in genetics, but requires specialists in plant physiology, anatomy, pathology, and entomology. Studies range from geographic variation of important species to quantitative genetics and the physiology of disease resistance. Extensive plantations provide data on variation and inheritance of important traits.

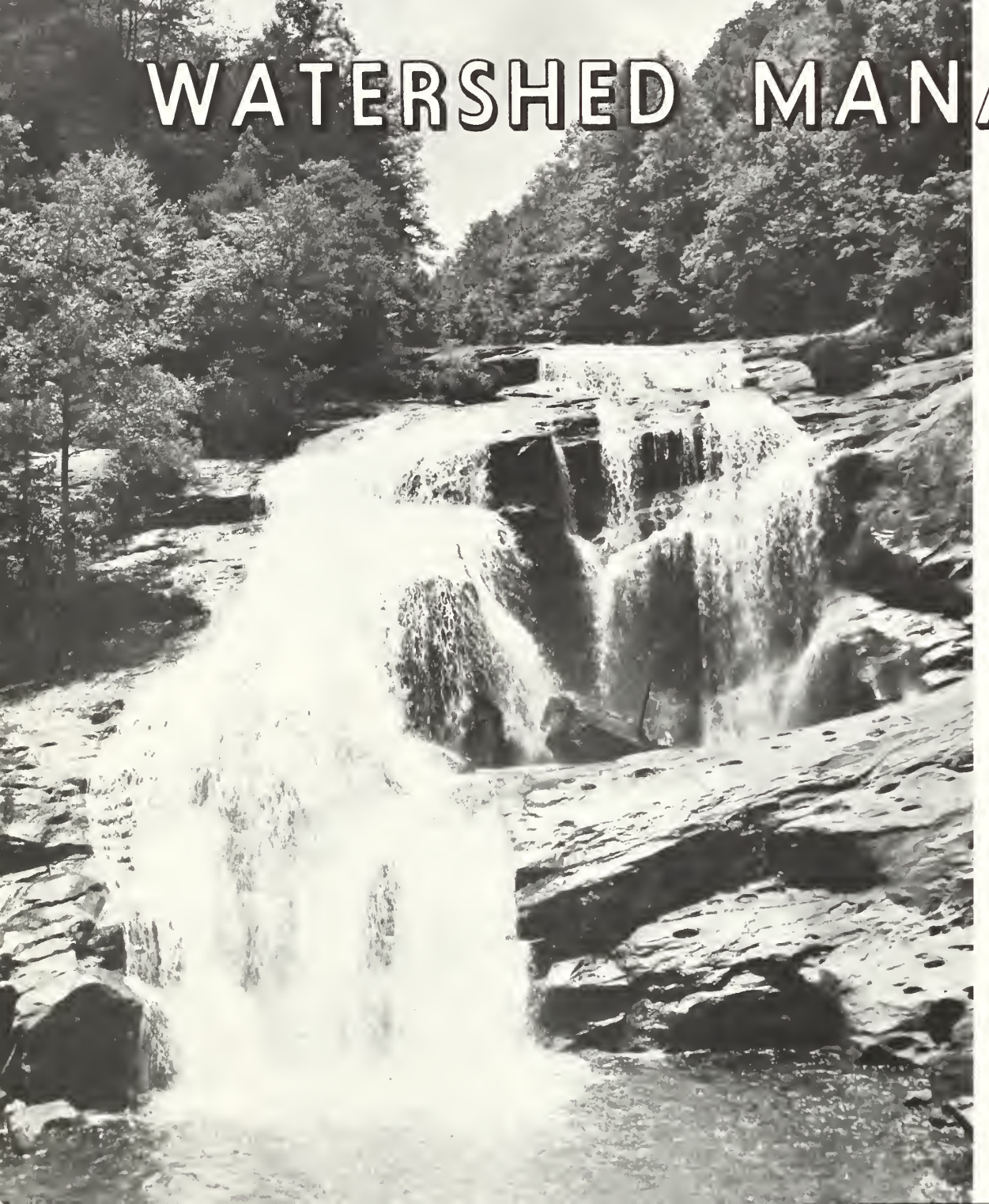
The work will lead to the development of hardwoods and pines that are superior to run-of-the-woods stock. Such trees can be expected to grow high-quality wood at a very fast rate, and to be unusually resistant to diseases and insects.

This graft from a plus-tree selection of sweetgum has been established in a breeding orchard. It will be used as a parent in studies of inheritance of important traits.

The immense variation among trees is what the geneticist works with: by selecting and breeding the best he can produce the very best. For example, when 13 longleaf pines were interbred to determine the inheritance of various characteristics, the resulting families ranged widely in stem and branch habits but included some of the splendidly formed specimens that geneticists call plus trees:



WATERSHED MANAGEMENT



Almost all of the water we use originates as rain or snow on a watershed. Man may never be able to control rainfall completely, but he can manipulate the watershed conditions which either make much of that rainfall available or waste it.

Forests are excellent protection for watersheds. Their effect begins before raindrops hit the ground. Twigs, branches, leaves, and needles break up drops and reduce the force of their impact. Forest litter under the trees takes up the rest of the shock, and eases the water to the soil beneath.

Soil under forest stands absorbs water easily. Its top layer is usually a spongy humus. Beneath this porous surface, the soil's texture has been loosened by roots, and by organisms found only under living vegetation. Thus forests catch and hold the water while it percolates slowly to the soils that replenish streams, and to the deeper layers that serve as underground reservoirs.

The Southern Station's watershed research seeks to develop recommendations for managing forests on watersheds of the Midsouth. This research is carried out in three projects: one at Harrison, Arkansas, and two at Oxford, Mississippi.

On most streams, in most seasons, flow depends upon the kind of forest on the watersheds, and how well the forest floor absorbs rainfall for storage in the soil. Thin, rocky soils of the mountains present special problems to watershed managers.

Flumes installed on study watersheds record the flow of runoff. Sediment is sampled by the revolving wheel.

WATER TIMING

Harrison, Arkansas

Mountain watersheds are special management problems, because slopes are steep and soils are shallow. Heavy rains readily turn into floods. The sparse soil stores so little water that streams go dry when rains fail. Forest cover adds extra storage in litter layers, and thus keeps soils permeable and reduces water losses during heavy rains.

The research project at Harrison deals with watersheds in the Ouachita Mountains and Ozark Highlands of Arkansas and Missouri. The prime objective is stabilization of flow in small streams to assure an acceptable year-round yield of good water.

Research is under way to:

Study the depth and character of mountain soils, and learn how fast they take in and transmit water, and how much water they can hold.

Determine how tree roots and surface litter affect absorption, storage, and erosion.

Find out how fast trees use water from the soil, and how much this use changes as old trees are cut and replaced with seedlings.

Test various cutting methods to determine their effects on streamflow.

Investigate water behavior as it is influenced by soil character and vegetation.

Field studies are on the Alum Creek Experimental Forest near Hot Springs, the Koen Experimental Forest near Harrison, and at plots supplied by landowners and industries throughout the mountain areas.

Dependable flows of clear water from watersheds protected by forest cover are needed for irrigation, domestic use, and industry.

Soil erodes from unprotected watersheds, clogging drainageways, muddying streams, and burying fertile bottom lands.

Water losses from interception by tree crowns can be reduced by thinning dense stands.

Forest litter keeps the soil in place. Researchers study the effects on litter accumulation of the kinds, spacing, and harvesting of trees.

COASTAL-PLAIN HYDROLOGY

Oxford, Mississippi

Most Coastal Plain soils are deep and have an immense capacity for holding water. They can take in and store rain during the wet seasons, and release water into the streams during dry weather, or add it to ground-water supplies. Practically all of the usable fresh water in the South passes through these soils. The cover on these lands, especially that provided by forests, determines how effective this storage is.

Hydrology research is one of the two projects headquartered at Oxford. It investigates the effects of forests on streamflow and groundwater recharge. This is the first Forest Service research of its kind in the Coastal Plain, where already many communities are feeling the first hints of water shortages.

Questions like these must be answered:

How do geology and soils affect groundwater? Where are the areas of recharge for streamflow and groundwater reservoirs?

What types of cover are most efficient in getting water into the soil? How does cover type relate to different soils?

How can soil permeability be increased by forest growth? Where are such increases needed most critically, and how do we start attaining them?

How much soil moisture do trees use? What stand density is best for watersheds?

How much of the rainfall is intercepted by tree crowns?

REHABILITATION AND MANAGEMENT OF EROSIVE WATERSHEDS

Oxford, Mississippi

The hills of north Mississippi and west Tennessee exhibit some of the worst erosion in the South. Here, more than a century of row cropping on erosive sites produced bare, jagged wastelands. Sediment picked up and carried downstream by excessive runoff has clogged drainageways, buried fertile bottom lands, and filled reservoirs.

The goal of this project at Oxford is to find the best ways to rehabilitate eroded lands and to manage them to avoid floods, erosion, and sedimentation.

Researchers work with grasses and other low-growing plants, as well as mulches and small damming structures, to get prompt temporary control of erosion. For permanent control they depend primarily on pine trees, whose falling needles continuously replenish a blanket of litter that holds the soil in place. They test new varieties of plants, new ways of planting, new fertilizers, and new ground covers in a sustained effort to make erosion control cheaper, faster, and more effective.

Temporary brush dams trap sediment in small gullies. African lovegrass is planted to stabilize the soil until planted pines can become established.

Already large areas of once-eroding land are stabilized and supporting their first merchantable crop in decades—trees. Researchers must guide landowners in harvesting this crop in ways that will not expose the soil to new cycles of erosion. To do this, they are working to determine:

How partial cutting affects the accumulation of protective litter under stands.

How to reproduce stands without exposing soil to erosion.

Whether prescribed burning can be used in managing timber on erosive sites.

Whether forage can be grazed without damage to such sites.

How local landowners can manage their timber both for erosion control and for profit.

An eroding gully in former cropland has been completely stabilized for more than 10 years by loblolly pine planted 25 years ago.

RANGE MANAGEMENT

Southern forests yield not only great volumes of wood but worthwhile quantities of forage useful for raising cattle. Owners of commercial timberland are becoming increasingly conscious of benefits of good forestry; many are not yet fully aware of what management of grazing resources can add to returns.

The custom has long been to graze woods range haphazardly and accept low beef production, but research has now shown the way to more profitable use of grass. Range specialists at Alexandria have developed systems of managing forage and animals to double beef yields and materially increase net returns, while conserving forest resources.

Until 5 years ago, information on improved utilization of forest range applied mainly to understocked longleaf pinelands. Now receiving major attention is the more formidable task of developing management systems for complete timber rotations in two major pine types—longleaf-slash and loblolly-shortleaf.

PINE - HARDWOOD CATTLE RANGES

Alexandria, Louisiana

Forest range research in the South began in 1943 to evaluate forage resources and determine how understory vegetation is affected by site conditions, fire, grazing practices, and timber management. Early studies revealed that the phosphorus content of range grass is insufficient at all seasons, and that protein is inadequate throughout the winter. Practical programs of supplemental feeding were devised to remedy these deficiencies and greatly increase beef production. Also developed was a way to conserve range vegetation and improve its food value by systematic prescribed burning and control of grazing pressures.

With several fundamental problems largely resolved, research shifted to coordination of cattle raising and timber production. Current studies are assessing influences of several grazing intensities on soils and success of pine regeneration. Also under investigation are impacts of timber management systems on forage, including responses of important native grasses to soil, moisture, and light conditions as modified by pine overstories.

To be determined in future experiments are grazing influences on wildlife habitat, timber effects on forage utilization, and relation of supplemental feeding to pine browsing by cattle. Also planned are studies of the shade tolerance and nutritional quality of exotic grasses that promise to grow well under fully stocked stands of timber.

Clipping plots to measure herbage yield helps determine how many cattle a range will safely carry.

Supplemental feeding to supply nutrients that are scarce in forage can make forest grazing profitable.

Cows grazing in commercial pine forests produce quality calves if stocking rates are conservative and the herds receive good care.

WILDLIFE MANAGEMENT

Food—the search for it, or the eating of it—dominates the lives of most wild birds and animals. Shelter and water are important also, but the success of a species is largely determined by the kind and amount of food available during the entire year.

More than one-half million deer, more than 150,000 turkey, and untold numbers of squirrel and quail depend on Midsouth forests for food and cover; these forests could support many times the current populations. But trouble arises when the numbers of game birds and animals are out of balance with the habitat. With too little game, sportsmen are dissatisfied and much of the forage and mast goes to waste. Excessive populations lead to overuse of plants, death of game from undernourishment, and heavy damage to young trees.

Wildlife research is concentrated in the loblolly-shortleaf pine-hardwood forest types of the Coastal Plain, where potential forest-game conflicts are greatest. Other installations, in the mountains and in highly productive bottom-land hardwood areas, will contribute to an understanding of fundamental relationships between game and its habitat.

WILDLIFE HABITAT IN SOUTHERN FORESTS

Wild turkeys increase when habitats are suitable. (Texas Parks & Wildlife Department photo)

Deer depend heavily upon browse plants, such as the flowering dogwood.

Relationships between deer and their forest environment are studied in large fenced tracts.

Nacogdoches, Texas

Forests and wildlife generally occupy the same land. Whoever controls the woodlands controls the habitat of the birds and animals. Timbermen and wildlife men, understanding each other's needs and aims, can develop balanced management that will result in optimum yields of both wood products and game—without one interfering with the other.

The Station's wildlife habitat research project is headquartered at Nacogdoches, Texas. Major field installations are near Mountain View, Arkansas, and Winnfield, Louisiana. Some investigations are conducted in Mississippi and Alabama.

At Nacogdoches, habitat values for squirrels and deer are being investigated in two 153-acre enclosures, one of which has no mast-producing hardwoods. Also, efforts are made to find which plants the animals like best, to determine what plants are most nutritious, and to learn how seasonal changes in food quality and quantity affect animal reproduction and growth.

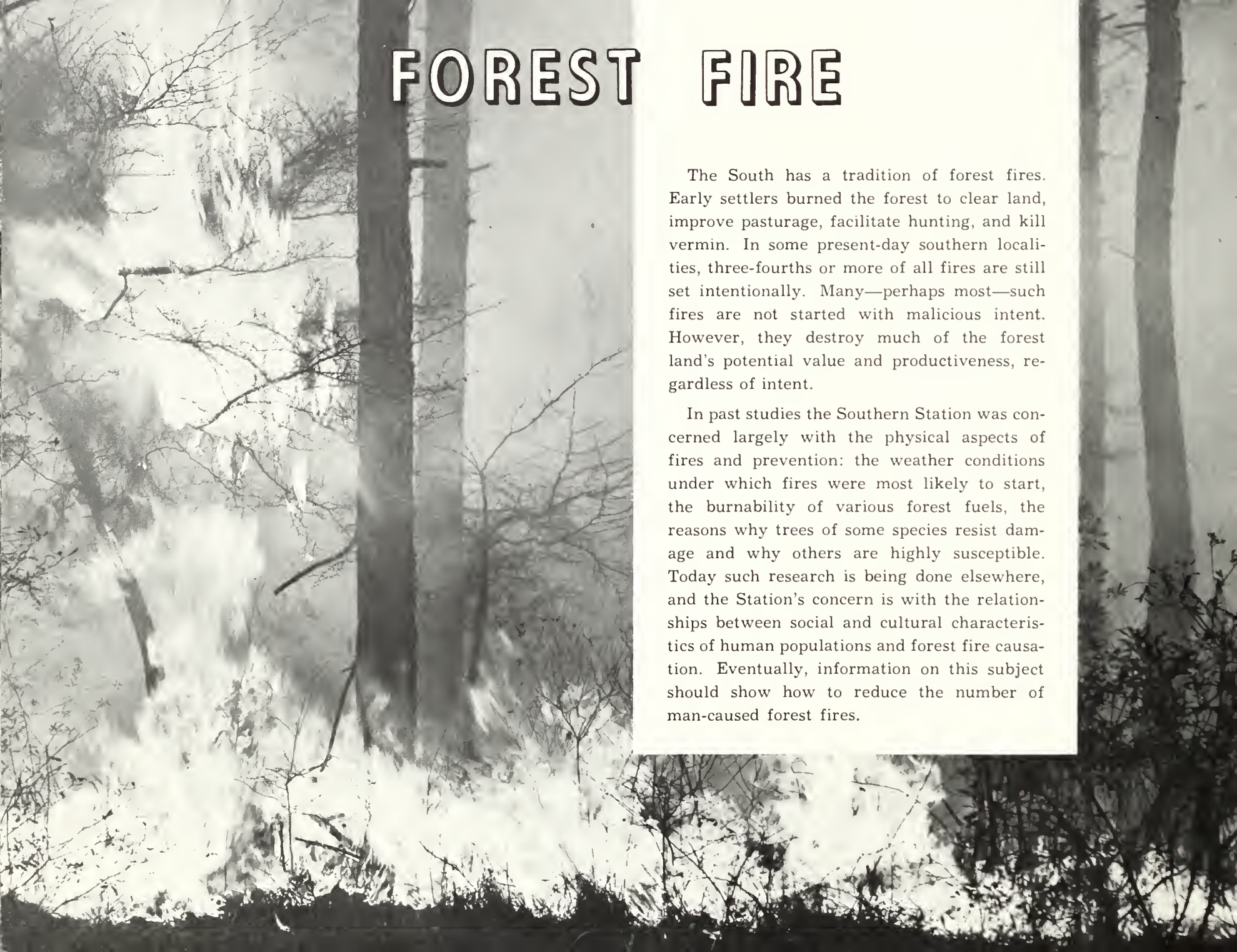
Near Winnfield, three 160-acre enclosures are stocked with 2, 4, and 8 deer apiece, to determine how browsing at these intensities affects forage yields and animal health.

Near Mountain View, researchers removed all deer from two square-mile enclosures in typical second-growth shortleaf pine-hardwood forests, and put back known numbers of animals. Changes in carrying capacity are being evaluated as the habitat is altered by timber cutting and planting of winter deer foods, and by other measures.

At several locations, scientists are studying how game food yields are affected by such factors as site quality, timber types, silvicultural practices, and prescribed burning. For some of the more important browse species detailed records are kept on times of growth, flowering, and seeding.

Squirrels are perhaps the most popular game in the South. (Texas Parks & Wildlife Department photo)

Special sampling devices help measure the crops of acorns produced under various forest conditions.



FOREST FIRE

The South has a tradition of forest fires. Early settlers burned the forest to clear land, improve pasturage, facilitate hunting, and kill vermin. In some present-day southern localities, three-fourths or more of all fires are still set intentionally. Many—perhaps most—such fires are not started with malicious intent. However, they destroy much of the forest land's potential value and productiveness, regardless of intent.

In past studies the Southern Station was concerned largely with the physical aspects of fires and prevention: the weather conditions under which fires were most likely to start, the burnability of various forest fuels, the reasons why trees of some species resist damage and why others are highly susceptible. Today such research is being done elsewhere, and the Station's concern is with the relationships between social and cultural characteristics of human populations and forest fire causation. Eventually, information on this subject should show how to reduce the number of man-caused forest fires.

The slow match is a favorite device of arsonists. In the time it takes for the cigarette to burn down to the matches, the woods-burner can get away.

PREVENTION OF MAN-CAUSED FIRES

State College, Mississippi

In a bad fire year the South has an average of eight forest fires for every hour of the day and night, all year long. For every hour of the year, 335 acres of forest burn and fire-fighting costs average $2,400. People start more than nine-tenths of the fires—about half of them deliberately.

Since most forest fires are man-caused prevention becomes chiefly a matter of working with people. Fire prevention research utilizes the skills of trained social scientists—personnel from State colleges and experiment stations who have well-established contacts and a long history of success in dealing with rural people. The aim of this cooperative research is to find out why people believe and act as they do in regard to fire, and how they may be induced to adopt behavior that will result in fewer fires.

Fire prevention starts with people. Researchers interview residents in high-incidence areas to learn their attitude toward woods fires.

FOREST INSECTS

Many insects feed upon unprotected wood. They tunnel into the trunks of living trees, especially the hardwoods, lowering the quality of products. They bore into wood that is stored while it awaits manufacture. They gnaw lumber, buildings, paper, and furniture. The wood products pests alone cost Americans about a billion dollars each year.

But even more destructive are the insects that attack the leaves, twigs, roots, and inner bark of forest trees. It is almost impossible to estimate how many trees they kill and how much they reduce potential growth, but they cause a tremendous loss in southern forests each year.

Forest entomologists of the Southern Station are concerned with many types of insects. A project dealing with insect enemies of southern pines is located at Alexandria, Louisiana. Insects that attack living hardwood trees are studied at the Southern Hardwoods Laboratory at Stoneville, Mississippi. The Wood Products Insect Laboratory at Gulfport, Mississippi, is continuing well-established research programs on termites and other insects that damage wood in storage or in use.

INSECT ENEMIES OF WOOD

Gulfport, Mississippi

Worker termites—the ones that do the damage—are tiny, blind, soft, defenseless creatures that look like small grayish-white ants. The only fierce thing about them is their appetite for wood.

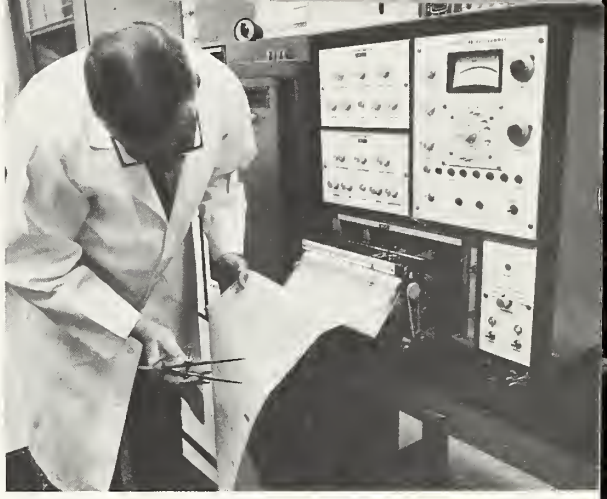
The most destructive termites are the subterranean species. As their name implies, they live in the ground. They enter buildings only to seek food and must return to the soil frequently for moisture. Gulfport research has shown that buildings can be protected by treating the soil under them with chemicals, so that termites cannot get through. Some chemicals have given 100-percent protection for at least 17 years.

Gulfport researchers have also devised methods of protecting stored rough products such as pulpwood, saw logs, and unfinished lumber from the attacks of bark beetles, wood borers, and ambrosia beetles.

Current studies are on the biology and control of the powder-post beetles and subterranean termites, including the recently discovered Formosan termite.

Major field installations for the project's research are at the Harrison Experimental Forest, but tests are also under way at 11 other locations in continental United States, Hawaii, and the Panama Canal Zone.

Subterranean termites cause millions of dollars in damage each year to wood in unprotected buildings.



Analyzing soil samples by gas chromatography, to determine insecticide residues of chemicals applied to control termites.

Powder-post beetles attack stored wood and wood in use. Current studies seek controls for these and similar pests.

INSECT ENEMIES OF HARDWOOD TREES

Stoneville, Mississippi

Insects that bore into the bark and trunks of hardwood trees are of special concern to southern hardwood lumbermen. These borers and scarrers degrade the wood, causing an annual loss estimated at more than $40 million. Other kinds of insects, such as the cottonwood twig borer, stunt and deform trees. The forest tent caterpillar and other pests defoliate thousands of acres of hardwoods. Successive defoliations slow the growth of these trees and sometimes kill them.

Research has shown that many of the defoliators can be controlled by aerial spraying, but further tests are needed to insure that there are no adverse effects upon fish and wildlife. The cottonwood twig borer can be controlled with a systemic insecticide, phorate. Insecticides often have disadvantages for forest use, however, and the aim is to develop other kinds of controls. Current research is concentrated largely on the carpenterworm, which is perhaps the most damaging of all the borers. Scientists are seeking to control it by using a potent sex attractant (secreted by the female moth) to lure male moths to a chemical that will sterilize them. Females mate with sterile males but produce infertile eggs. Release of large numbers of sterile males during the mating season might thus reduce carpenterworm populations considerably.

Male carpenterworm moths being lured into a trap cage by the sex attractant of a female moth inside. Males thus captured have returned to such traps when released as much as a mile away.

The cottonwood twig borer kills the terminals of young trees; repeated attacks cause crooked trunks. Thus far, a systemic insecticide is the best protection for seedlings.

Borers that attack living hardwood trees cause loss through degrade. Such defects often escape discovery until the log is sawed into lumber.

Forest tent caterpillar eggs: upper mass contains larvae; lower one, empty egg cases.

The southern pine beetle is considered the most destructive forest insect in the South. These young adults are about ready to emerge from their pupal cells and begin a new generation. The photo is enlarged; in life the insects are about ⅛-inch long.

INSECT ENEMIES OF PINES

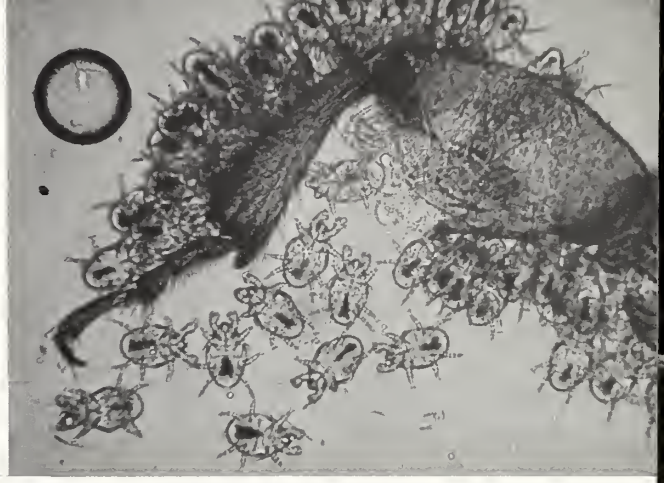
Alexandria, Louisiana

While hardwood insects seldom kill their victims outright, just one outbreak of the southern pine beetle can kill pines on thousands of acres.

Bark beetles, taken together, are the most destructive insects in the southern pinery. Each year they ravage millions of board feet of sawtimber and large volumes of pulpwood. The southern pine beetle causes the most spectacular damage of the group because it breaks out in wildly destructive epidemics. The black turpentine beetle and three species of *Ips* engraver beetles continue a widely dispersed, less flamboyant activity which may destroy more timber over the years than does the southern pine beetle.

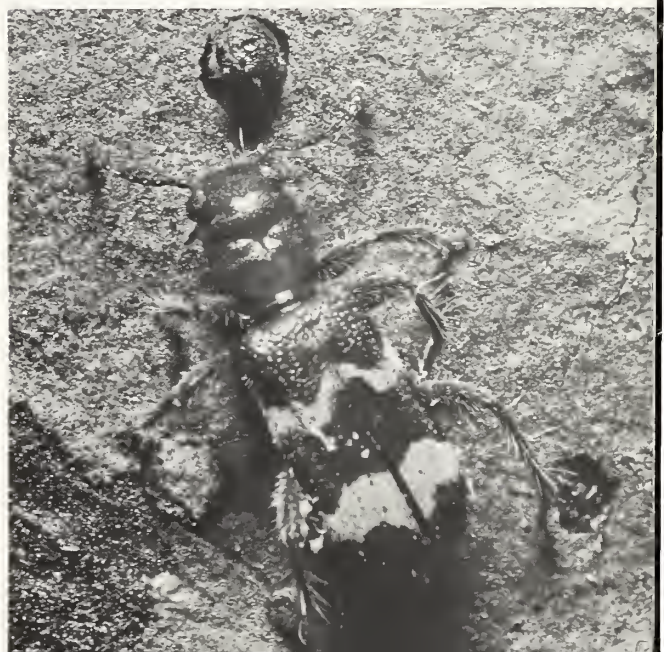
Known controls for bark beetles are expensive and not entirely effective.

Major endeavors of the insect research project at Alexandria are to find ways of managing timber so as to prevent bark beetle outbreaks, and to learn how to make effective use of the beetles' natural enemies, such as parasites, predators, and disease organisms. At the same time, economical and selective chemical controls are being sought as a stopgap until more positive ways of protecting the forests are developed.

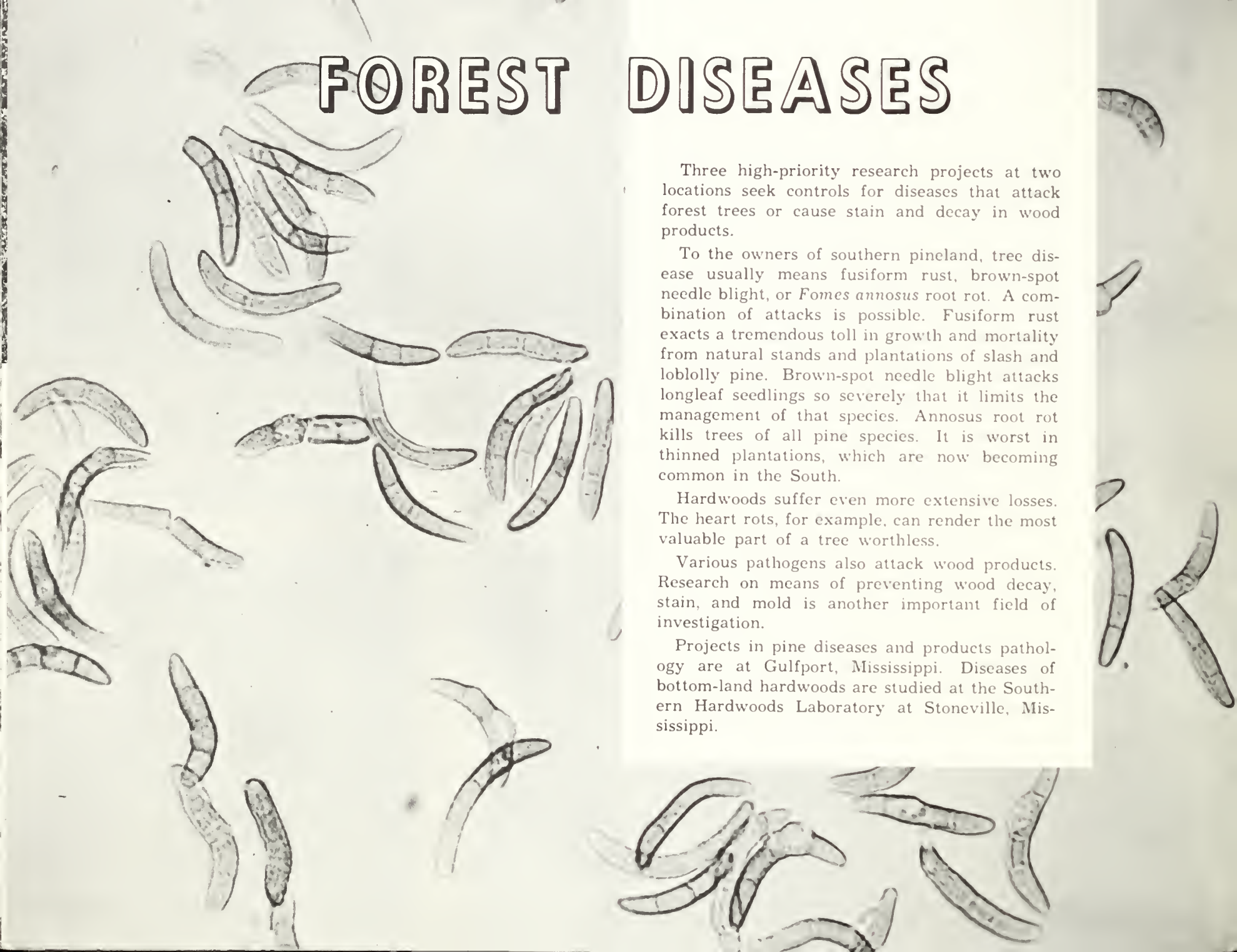


Tremendous numbers of mites attach themselves to adult southern pine beetles: the importance of these parasites is under study. This picture shows the leg of a mite-ridden beetle.

Besides mites, southern pine beetles have clerid beetles to contend with. Here an adult clerid waits to eat a southern pine beetle emerging from a tree. Clerid larvae also eat pine beetle larvae. Perhaps there are ways of increasing the populations of such predators.



FOREST DISEASES



Three high-priority research projects at two locations seek controls for diseases that attack forest trees or cause stain and decay in wood products.

To the owners of southern pineland, tree disease usually means fusiform rust, brown-spot needle blight, or *Fomes annosus* root rot. A combination of attacks is possible. Fusiform rust exacts a tremendous toll in growth and mortality from natural stands and plantations of slash and loblolly pine. Brown-spot needle blight attacks longleaf seedlings so severely that it limits the management of that species. Annosus root rot kills trees of all pine species. It is worst in thinned plantations, which are now becoming common in the South.

Hardwoods suffer even more extensive losses. The heart rots, for example, can render the most valuable part of a tree worthless.

Various pathogens also attack wood products. Research on means of preventing wood decay, stain, and mold is another important field of investigation.

Projects in pine diseases and products pathology are at Gulfport, Mississippi. Diseases of bottom-land hardwoods are studied at the Southern Hardwoods Laboratory at Stoneville, Mississippi.

DISEASES OF BOTTOM-LAND HARDWOODS

Stoneville, Mississippi

More timber volume is lost in bottom-land hardwoods from heart rots than from any other cause. Most heart rot results from fungi entering the tree through wounds made by fire, and could be prevented by keeping fires out of the woods. Since this is difficult to do throughout the entire life of a stand, some fire wounding and resulting decay is almost inevitable.

As an aid to the forester in determining when a wounded tree should be salvaged, pathologists have determined how fast decay develops in different trees, and how the amount of decay can be estimated from external signs.

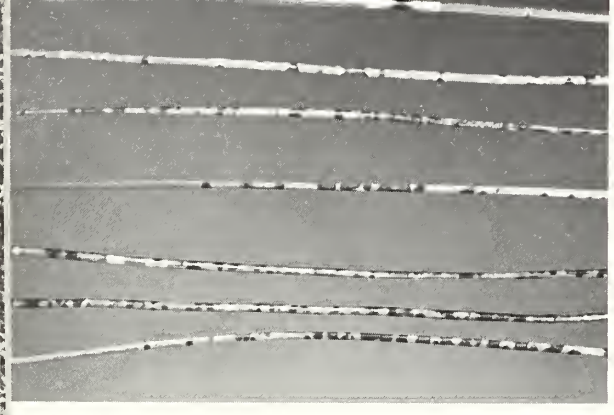
Now the scientists are exploring the biologies of the fungi that cause rot. They would like to know exactly how spores spread the fungi from one tree to another. Under what weather conditions, for example, does a conk release its spores? How far do the spores travel and how long can they live? With such knowledge, it might be possible to devise ways of minimizing the infection that occurs when fires or storms wound trees.

Mycorrhizae—those rather strange associations of fungi and tree roots—are also under study. Progress has been made in identifying the fungi that form mycorrhizae on hardwoods. A further question is when the associations are beneficial and when harmful.

Heart rot takes a terrific yearly toll of southern bottom-land hardwoods. Entry is usually through basal wounds made by fire.

Under most conditions, mycorrhizae are essential to the growth of hardwoods. The sweetgum seedling at left is growing in a medium inoculated with a mycorrhizal fungus. The other medium was not inoculated.

DISEASES OF PINES



Typical lesions of brown-spot needle blight on longleaf pine. The disease is often largely responsible for longleaf's slow early height growth.

The southern fusiform rust is the most serious disease of slash pines, sometimes destroying entire plantations. Spindle-shaped cankers on the trunk or limbs are the mark of the disease.

Gulfport, Mississippi

Fusiform rust and brown-spot needle blight account for most of the enormous, perpetual, disease-caused drain on the southern pinery. The main emphasis of the Southern Station's pine disease research is on the biologies of these two despoilers; the project is located at the Forest and Wood Products Disease Laboratory, Gulfport.

Laboratory and greenhouse studies probe the life histories of the disease organisms. Scientists also want to find out exactly what these pathogens do to the plant—to its life functions, its tissues, and its individual cells.

Fomes annosus root and butt rot, currently widespread but intense in only a relatively few local areas, is potentially a serious menace. It can cause severe root decay of planted pines after stands are thinned, and trees so weakened either die or blow over in high winds. The disease is worst on old-field sites, particularly those with sandy soils and little organic matter. Evidence suggests that previous cultivation of the soil is responsible for an imbalance between the pathogen, the host trees, and the natural soil microorganism competitors of *Fomes annosus*. Pathologists at Gulfport are trying to identify the factors responsible for this imbalance and they are experimenting with prescribed fire as a possible method of controlling the disease. They theorize that replacement of heavy pine straw accumulations with vegetative cover such as legumes or grasses may be one practical means of encouraging a buildup of microorganism competitors.

These pines were killed by Fomes annosus, *a disease that infects pine plantations after the first thinning and causes severe root decay. (Photo by Kirtley-Perkins for International Paper Co.)*

WOOD DECAY

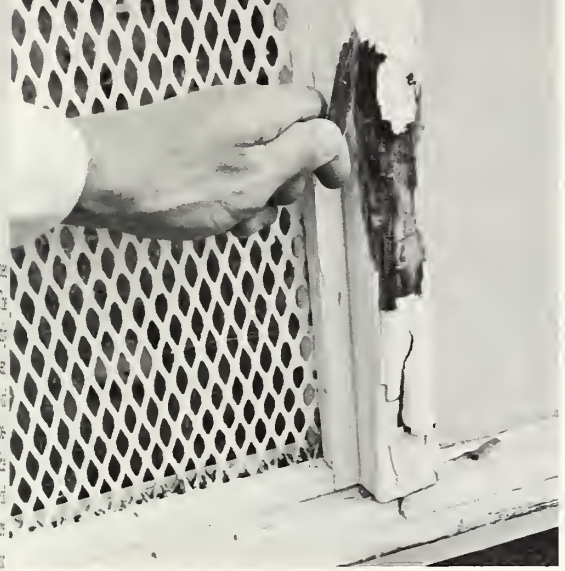
Gulfport, Mississippi

Most wood from southern forests has no natural resistance to fungus. From the moment a tree is cut and becomes a "product"—log, bolt, post, or piling—it is subject to infection by fungi that cause stain, mold, and decay. Unless precautions are taken, the organisms keep up their attack while the wood is hauled, stored, manufactured, and used.

Fungi that damage wood require moisture to exist. If wood can be shielded from moisture either through good building design or by water-repellent preservatives, it will hold up indefinitely even in the humid subtropic and tropic areas. Long-term studies by forest pathologists at Gulfport have shown how rainwetting of siding, trim, and other exterior woodwork is related to wall design, siding pattern, roof overhang, and type of finish.

These scientists have proposed methods, now in worldwide use, of protecting lumber during air seasoning. Their recommendations for building designs to reduce decay and other moisture-induced problems have also been widely accepted.

Basic studies are being conducted to learn why certain fungi decay wood. This research delves into both the physiology of the fungus and the composition of the wood.

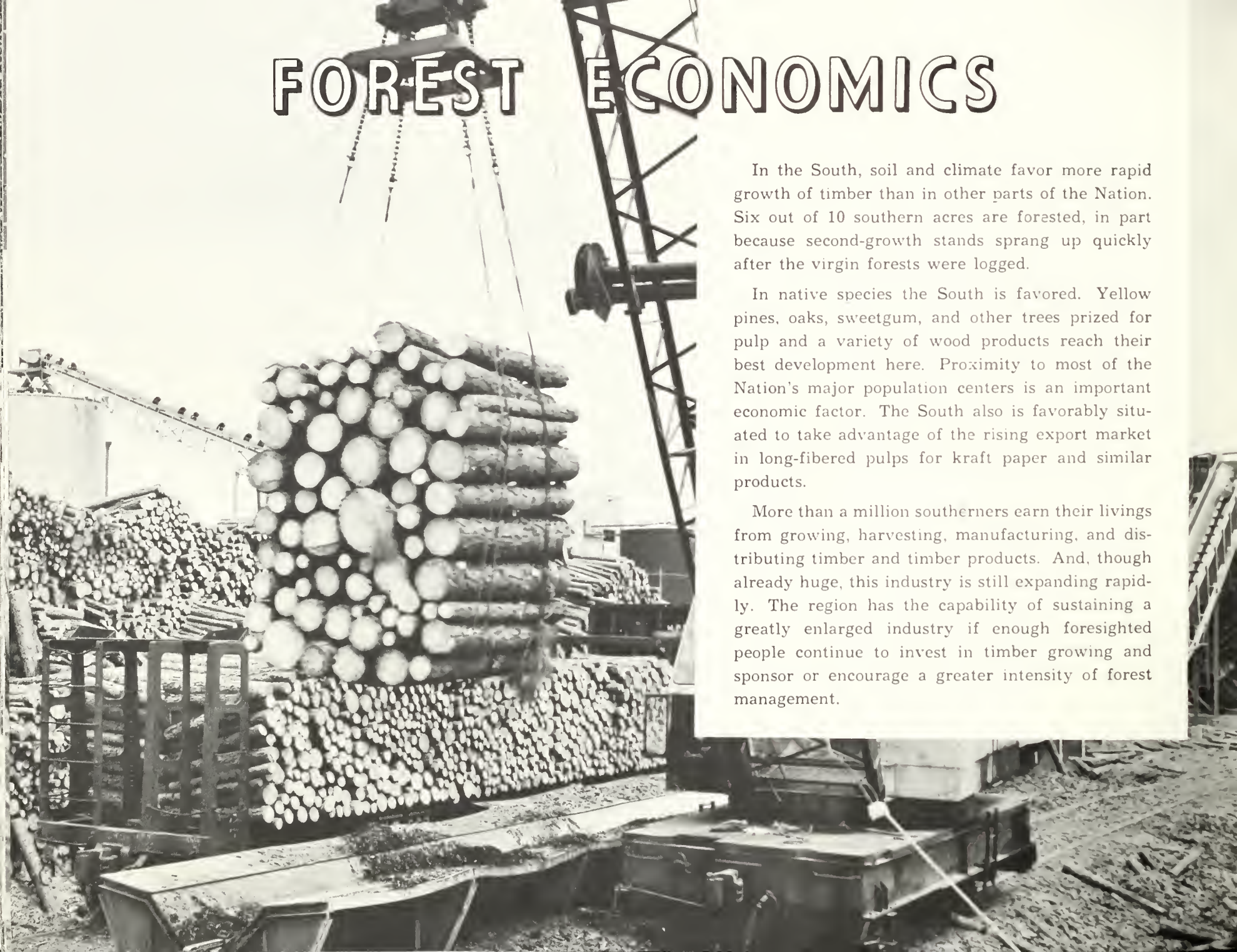


In the Midsouth alone, loss from wood decay is estimated conservatively at $50 million annually.

Wood is analyzed to determine the identity and amounts of nutrients which may be used by fungi.

Workers at Gulfport have learned how various coatings and types of construction retard decay of pine siding.

FOREST ECONOMICS



In the South, soil and climate favor more rapid growth of timber than in other parts of the Nation. Six out of 10 southern acres are forested, in part because second-growth stands sprang up quickly after the virgin forests were logged.

In native species the South is favored. Yellow pines, oaks, sweetgum, and other trees prized for pulp and a variety of wood products reach their best development here. Proximity to most of the Nation's major population centers is an important economic factor. The South also is favorably situated to take advantage of the rising export market in long-fibered pulps for kraft paper and similar products.

More than a million southerners earn their livings from growing, harvesting, manufacturing, and distributing timber and timber products. And, though already huge, this industry is still expanding rapidly. The region has the capability of sustaining a greatly enlarged industry if enough foresighted people continue to invest in timber growing and sponsor or encourage a greater intensity of forest management.

PRODUCTION ECONOMICS

New Orleans, Louisiana

The mission of this project is to determine:

The probable gains in southern timber output that would be associated with specific levels of investment in various forest management alternatives.

Influence on southern timber supplies of public programs for inducing and supporting efforts by nonindustrial landowners to manage their woodlands.

The effect on employment opportunities of increasing capitalization of the growing, harvesting, and processing of timber.

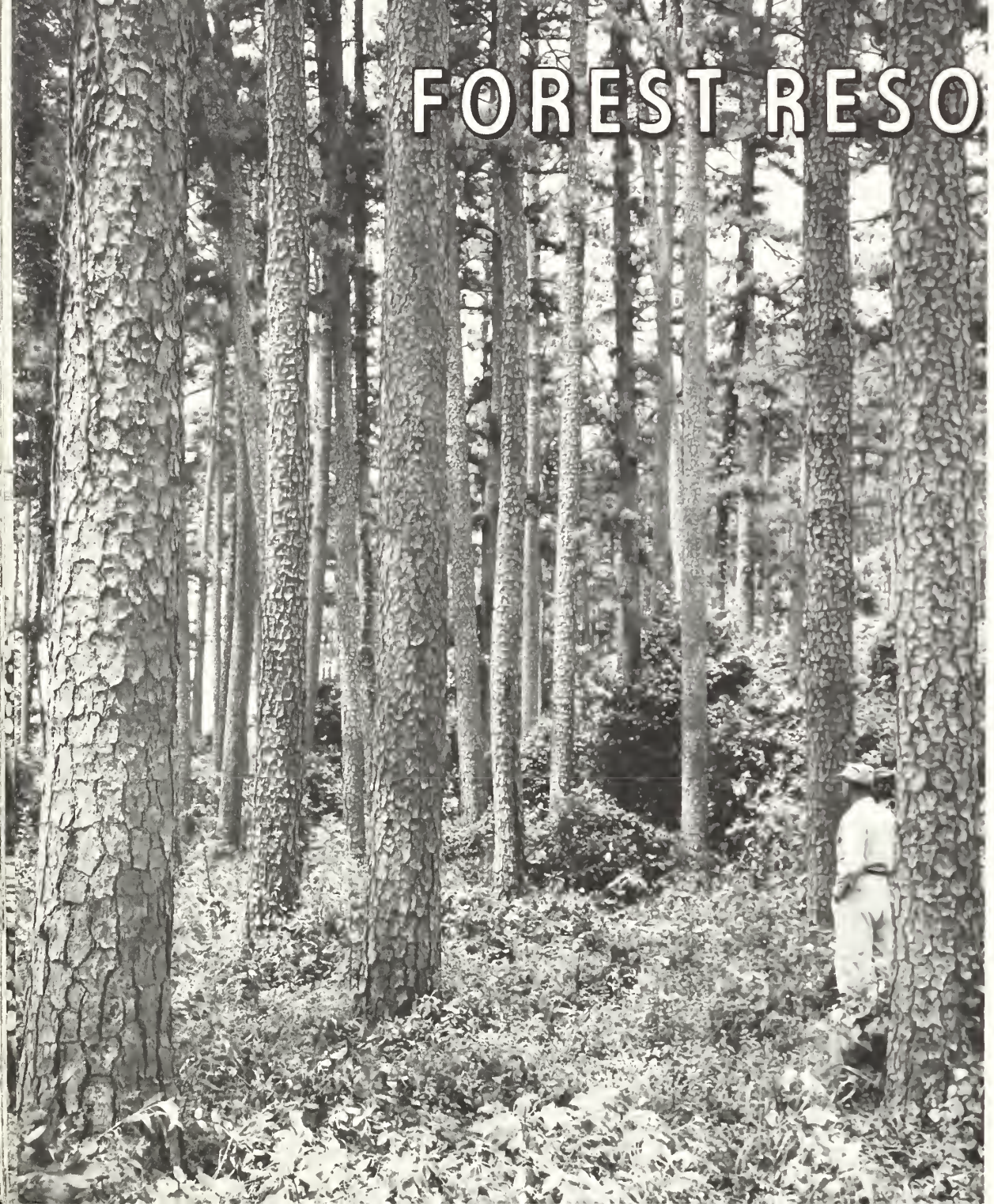
The employment supported and income contributed by the management of a unit of timberland and utilization of the timber by the lumber, pulp, and plywood industries.

Interregional competition between the South and other major forest regions in supplying the Nation's demand for forest products.

The input-output tableau for the southern forest economy.

The timber economy of the South will largely be determined by the policies of the nearly 2 million nonindustrial owners who hold more than two-thirds of the timberland in the 13 States from Virginia to Texas. The lands are producing one-third of the timber they are capable of growing. The average tract is small. Most of these owners get their income from sources other than timber, and many do not live on their land. Hence they have no strong economic incentive to manage their forests. The situation has existed for many years, but prospective needs for wood demand bold and imaginative concepts for gaining management of these tracts.

Expansion of the South's industrial opportunities requires that millions of acres of abandoned farmland be converted to forest.



FOREST RESOURCE

The forests of the Midsouth are mosaics of stands that vary widely in species, stocking, age, and productive capacity. In all, about 110 million acres are suitable for or are growing crops of industrial wood. This area accounts for one-fifth of the commercial forest land in the United States.

Forests of pine, either pure or mixed with hardwood, occupy about half of the commercial forest land in the Midsouth. The region's present eminence as a softwood-producing area is largely dependent on loblolly and shortleaf pine.

Hardwood forests include a rich variety of oaks, gums, hickories, and numerous other tree species that meet the diverse needs of timber-based industries. The lowland forests of the Mississippi Valley and tributary waterways include some of the most productive hardwood sites in America.

The second-growth pine and hardwood forests of the Midsouth are now producing about one-fourth of the Nation's annual timber growth. Although there are local imbalances, the pine forests are growing more timber than is being harvested. In hardwoods, total growth also exceeds the harvest, but large, high-quality trees are being removed faster than they are being replaced. Nearly all of the forest area, pine or hardwood, is capable of producing more and better timber than it is presently supporting. As timber management efforts increase, and as current research findings are put into use, opportunities will be created for the further expansion of existing wood-using industries and the establishment of many new ones.

FOREST SURVEY

New Orleans, Louisiana

The Forest Survey, or the "national survey of forest resources," is this country's only comprehensive and continuing source of timber resource facts. Information is obtained on:

The area and condition of forest land.

The volume, species, quality, and location of standing timber.

Ownership of forest land and timber.

Rates of tree growth and mortality.

Timber cut for lumber, pulp, and other purposes.

Location of wood-using industries and output of various timber products.

The Southern Station's Forest Survey Project is responsible for making inventories of the timber resources of the Midsouth. An inventory of each of the seven States comprising the territory served by the Station is completed about every 10 years.

Modern inventory procedures make use of aerial photos; interpreters in New Orleans first identify forested land and determine its extent. Then they locate on the photos the intersections of north-south and east-west grid lines, spaced several miles apart. Field teams travel to each point that falls on forested land and gather the required data. They then send their information to New Orleans, where it is placed on punch cards for compilation by electronic computers. Timber-production data obtained from scores of wood-using plants are also compiled by machine procedures. Analysts interpret these findings and report the results in *Resource Bulletins*.

Forest Survey information is applied in many important ways. Wood-using industries regard the timber resource facts as essential business statistics. They use them in deciding the location of new mills, expanding existing ones, planning wood procurement, and setting long-term management policies for company timberlands. In the South, Survey findings were essential to the vast expansion of the pulp and paper industry and the establishment of the pine plywood industry. Public agencies depend on these facts to help guide programs for resource development.

Each State's forest survey develops through several stages, including

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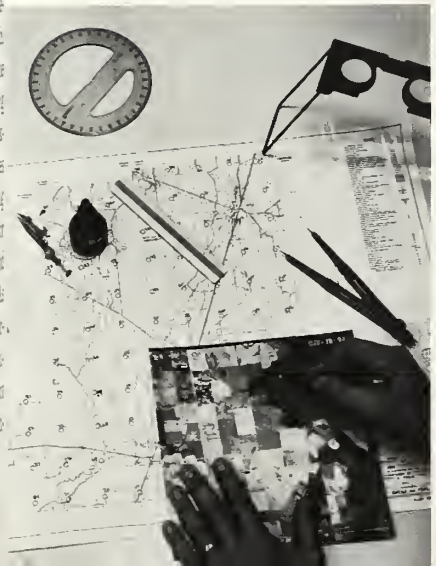

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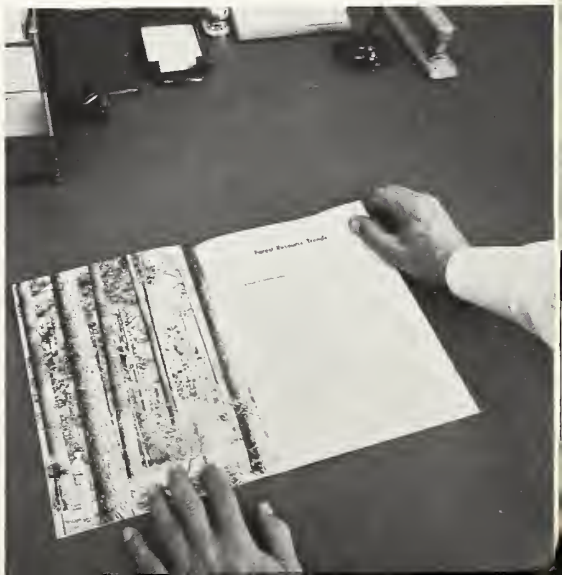
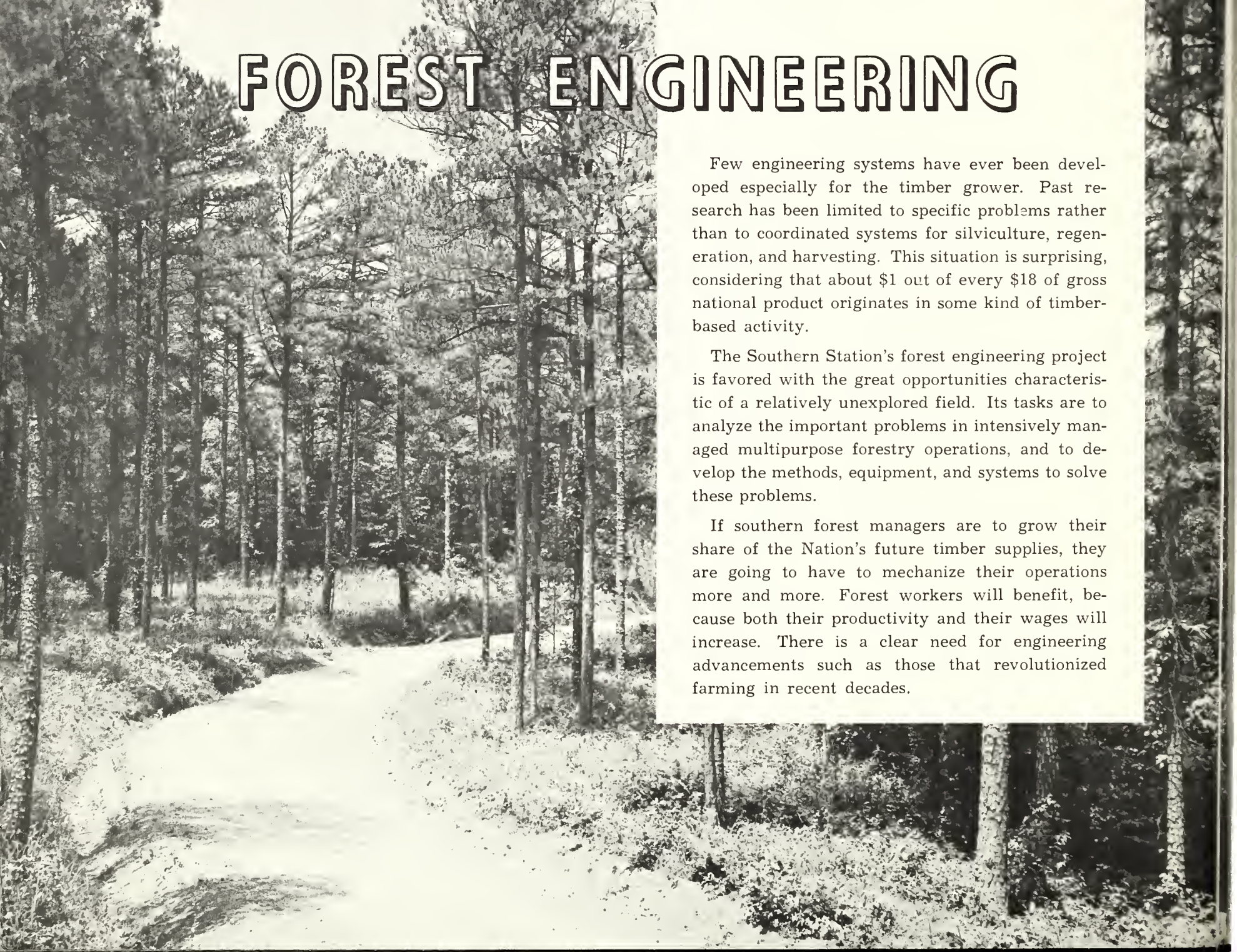


FOREST ENGINEERING



Few engineering systems have ever been developed especially for the timber grower. Past research has been limited to specific problems rather than to coordinated systems for silviculture, regeneration, and harvesting. This situation is surprising, considering that about $1 out of every $18 of gross national product originates in some kind of timber-based activity.

The Southern Station's forest engineering project is favored with the great opportunities characteristic of a relatively unexplored field. Its tasks are to analyze the important problems in intensively managed multipurpose forestry operations, and to develop the methods, equipment, and systems to solve these problems.

If southern forest managers are to grow their share of the Nation's future timber supplies, they are going to have to mechanize their operations more and more. Forest workers will benefit, because both their productivity and their wages will increase. There is a clear need for engineering advancements such as those that revolutionized farming in recent decades.

FOREST ENGINEERING SYSTEMS

Auburn, Alabama

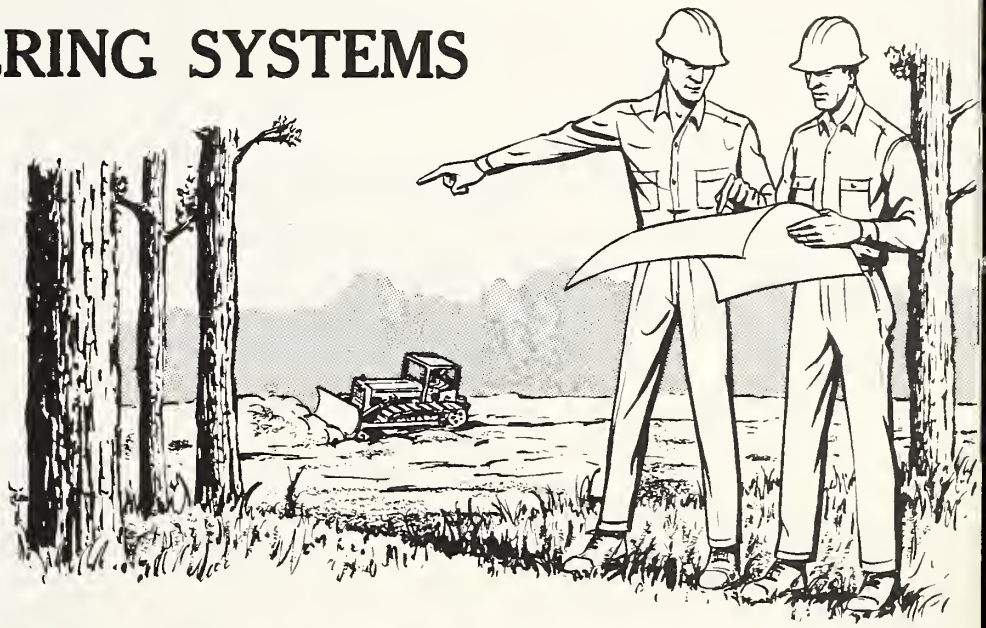
Improved engineering systems for intensive forest management are the objective of the Forest Engineering Laboratory established at Auburn in 1961. Increased efficiency will mean increased mechanization, but emphasis is on the design of entire systems rather than on piecemeal improvement of machine methods. The best opportunities appear to lie in regeneration, harvesting and transport, and naval stores.

Current research will produce methods for mechanically collecting pine seeds and sowing them to establish deliberately patterned forests. Studies to predict trafficability of harvesting machines over varying forest terrain are in process. New procedures and tools for collecting naval stores are in sight.

Cooperative studies with Auburn University are utilizing new methods of computer-based model building and simulation, thereby expanding the number of alternate system components the designer can explore.

Forest engineering research views forestry operations in broad perspective. Overall objectives are to reduce the cost of the raw materials, improve labor output, and eliminate the physical drudgery often associated with woods work.

The result will be to increase the profitability of forest enterprises and to make life more productive and pleasant for the people who earn their livelihood in such activities.



Modern harvesting machines are a vast improvement over the mule. Forest engineering research aims to increase profits and benefit people.

FOREST PRODUCTS UTILIZATION

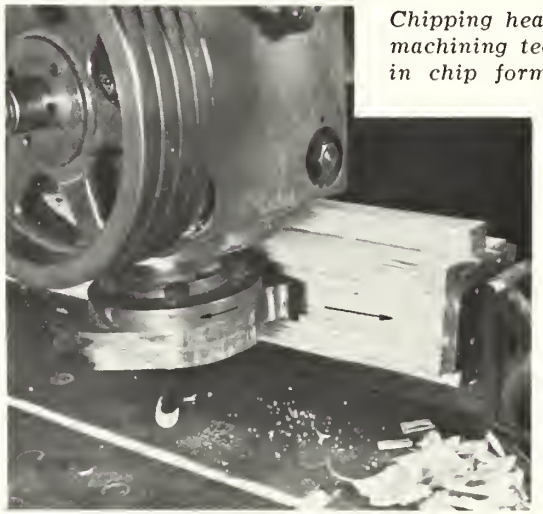
The new pine plywood industry and the rapidly increasing pulping capacity of the Midsouth are forcing new standards of wood utilization. New products and processes must use smaller logs and eliminate waste. Further, manufacturers must not add to the pollution of our water or air. Application of extraordinary new techniques requires ingenious new conversion systems, and the design of unique new products is made possible only by a broadening knowledge of the raw material.

Just one such conversion concept is the chipping headrig, which squares a round log without sawdust or other waste. Three configurations were developed by the Utilization Research Project at Alexandria, La. Two of them already have wide industrial application.

Superstrength laminated beams made from small pine logs, improved pine plywood, and straight studs from veneer cores are other recent developments of the Alexandria Project.

In current research, one major aim is to define the wood characteristics and processing variables affecting products made from fibers disk-refined from loblolly pine chips. Another is to delineate the factors controlling the performance of particle board made from southern pine wood. Still another is to develop an economic, improved glue for southern pine plywood: one that will reliably bond latewood to latewood and will be suitable for wood of all densities.

In addition to projects having early practical application, basic research is underway on the nature of wood as an industrial raw material. The ultimate goal is a comprehensive tabulation of the important physical, mechanical, chemical, and anatomical properties of the 10 species usually referred to as the southern pines.



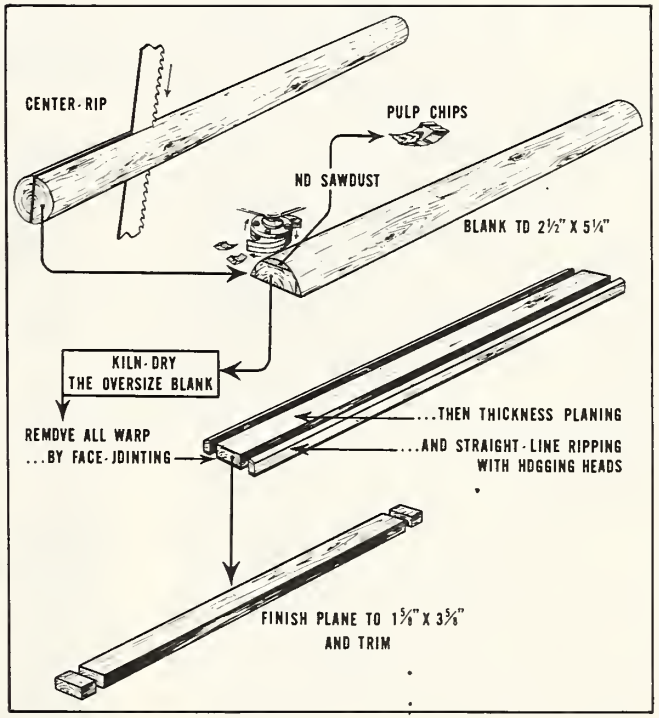
Chipping headrigs, the newest development in wood-machining technology, stem from laboratory research in chip formation accomplished during 1953. This research culminated in 1963 with laboratory setups for squaring a cant with a cutterhead instead of a saw. The basic idea is to remove wood outside the cant in the form of chips for pulping, and thus to avoid making slabs or sawdust. The picture shows one of three experimental headrigs developed in research at Alexandria.

Today several firms are manufacturing chipping headrigs commercially. In this model logs enter from either side of the infeed chain, which runs at 183 feet per minute. Production is about 100,000 board feet of lumber per 8-hour shift. (Photo by Stetson-Ross)

Superstrength laminated beam. Wood's extreme variability in strength plagues both sellers and users of structural timbers. To use this variability to advantage, Alexandria researchers in 1963 developed a system of making very strong and stiff beams by placing the most limber laminae in the center of the beam and the stiffest in the highly stressed outermost regions.

An enlarged edge of ⅜-inch southern pine plywood. Research at Alexandria has shown manufacturers can extend and predict the life of this product.

The characterization of southern pine wood as an industrial raw material requires advanced research techniques and equipment such as this sophisticated light microscope.



Alexandria researchers have developed a system for making straight, kiln-dry 8-foot studs from small southern pine trees or from the cores left after veneer bolts are peeled. Each bolt or core yields two straight studs. Application of the system could boost industry's gross income by several million dollars annually.

RESEARCH SUPPORT SERVICES

By and large, the Station's scientists are versatile people. If the roof leaks, they can get it fixed. They can construct special equipment, make out payrolls, and recruit and train secretaries. If they don't already know how, they can learn to plan buildings, supervise contractors, devise special methods of analyzing data, and mark their manuscripts with detailed instructions for typesetting.

If they had to do all these things, though, they wouldn't have any time left for research. To free scientists from all possible housekeeping chores and to provide specialized skills is the purpose of Research Support Services. This wing of the Station is divided into four branches: Research Information, Facilities Engineering, Operation, and Biometrics Systems.

RESEARCH INFORMATION

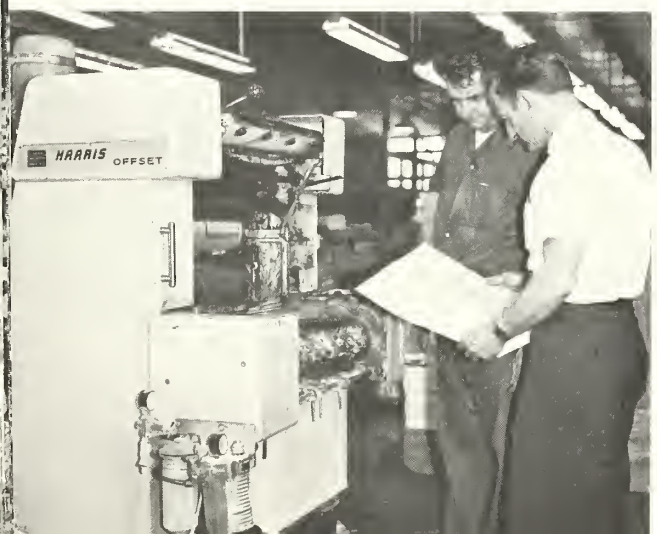
The Station regards its research as incomplete until the results have been published where they will be available to all who may wish to see them.

The **Editorial** section helps researchers prepare their findings for publication in scientific journals or in the several series of bulletins issued by the Forest Service and the Department of Agriculture.

The **Printing** section plans and supervises the printing of such bulletins as are issued locally *(Research Papers, Resource Bulletins,* and *Research Notes),* procures reprints of articles published in journals, and mails copies of Station publications to all who request them.

Research Information puts research results into easily readable form for audiences not reached by the scientific journals. It aids scientists in preparing how-to-do-it articles.

The **Library** provides scientists with books, pamphlets, and periodicals. By its access to the superb collections of the National Agricultural Library, and through interlibrary loans elsewhere, it can obtain virtually any known publication.



FACILITIES ENGINEERING

If that leak in the roof signals a major repair job, the Station engineer begins to worry about ways of accomplishing it with minimum inconvenience to the scientists and at minimum expense to the taxpayer. Maintenance of buildings and other Station facilities is his responsibility. So is new construction; when a laboratory is to be built he consults architects to insure that the plans are appropriate, and he works with the contractor to see that standards and schedules are met. He is also a practical expert on instrumentation, aiding scientists in designing and procuring the sometimes specialized and complicated tools they need in their work.

OPERATION

This branch encompasses the areas of Administrative Management, Personnel, Budget and Finance, and Administrative Services. It also provides complete support activities through Field Support Units at laboratories remote from Station headquarters.

Administrative Management plans and organizes the Station's administrative operations, heads the Cost Reduction and Operation Improvement Program, and coordinates the Employee Suggestion Program. Its objective is to continually find ways of improving procedures to accomplish jobs effectively and efficiently.

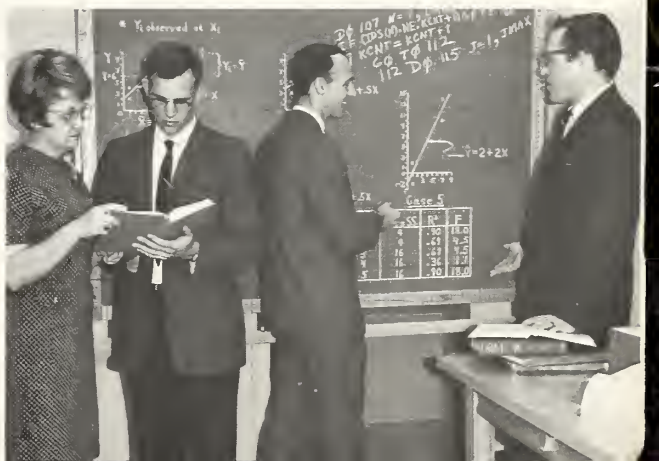
The **Personnel** section welcomes new employees to the Station on their first day of work, and it aids them in planning retirement when they are ready to close their careers. It is also busy in between, for in addition to processing appointments and separations it classifies positions, determines pay, and processes promotions and other status changes. It records award and performance evaluations, and helps with on-the-job and outside training. It looks to such matters of employee welfare as health benefits, insurance, leave, and injury compensation. It takes an active part in the Equal Employment Opportunity Program.

Administrative Services is concerned with management of property, procurement, contracting, office space, motor vehicles, records, and forms. It provides mail, messenger, duplicating, receptionist, and typing services.

The **Budget and Finance** section furnishes guidance and counsel on budgetary and fiscal matters, prepares and executes the Station's budget, provides accounting services, pays the Station's bills, and drafts and administers formal research agreements with cooperators.

BIOMETRICS SYSTEMS

Forest research techniques have greatly benefited by the application of biometric methods and advances in computer capabilities. The Station's biometricians are a main link between researchers and this developing technology. They advise on the design and analysis of studies, train scientists in standard biometric methods, and review the analytical portions of manuscripts and reports. In some instances they do their own research on biometric methods. Through this unit the Station scientists receive data-processing and computer-programming services.



A WORD ABOUT PUBLICATIONS

Most of the manuscripts by Southern Station personnel are published in one of three ways: by periodicals (scientific journals, trade or conservation magazines); through the U. S. Government Printing Office; or by the Station itself. No matter where an item is first printed, the Station usually obtains and distributes free copies or reprints.

Most of the publications that the Station issues fall into three numbered series: U. S. Forest Service Research Notes, U. S. Forest Service Research Papers, and U. S. Forest Service Resource Bulletins. Each series carries the identifying letters SO (for SOuthern Station), and is numbered in sequence: SO-1, SO-2, SO-3, and so on. The first in each of these series (SO-1) was issued in 1963.

The Station also puts out a few unnumbered items. These include descriptive booklets such as this one, maps, and miscellaneous material of very localized interest.

You may obtain specific publications from the Station, or be put on the mailing list to receive new publications on subjects of interest to you.

FOREST AND RANGE EXPERIMENT STATIONS AND FOREST PRODUCTS LABORATORY
FOREST SERVICE, U. S. DEPARTMENT OF AGRICULTURE